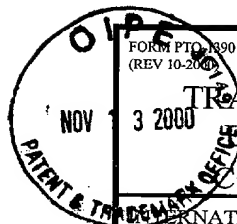


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414 Rec'd PCT/PTO 13 NOV 2000

PCT #

FORM PTO-1890
(REV 10-2000)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

33718 PCT USA

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)

09/700512

INTERNATIONAL APPLICATION NO.

PCT/GB99/01551

INTERNATIONAL FILING DATE

14 May 1999 (14.05.99)

PRIORITY DATE CLAIMED

15 May 1998 (15.05.98)

TITLE OF INVENTION

A BEVERAGE

APPLICANT(S) FOR DO/EO/US

Simon Daniel Scullion; Peter Thomas Foster; Stephen Paul Smith

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to promptly begin national examination procedures (35 U.S.C. 371(f)).
4. ☒ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ has been communicated by the International Bureau.
 - c. ☒ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☒ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☒ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 16 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:

PCT Notice under PCT Rule 47.1(c) (first sentence).



Form PTO-1390 (REV 10-2000) page 2 of 2

Attorney's Docket No.
33718-PCT/USA

09/700512

PATENT
529 Rec'd PCT/PTC 13 NOV 2000

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

Applicant : SCULLION, S., et al.
Serial. No. : To be Assigned
Filed : November 13, 2000
For : A BEVERAGE

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Upon the filing of the application referred to above,
please amend the application as follows:

In the Claims:

Cancel claims 1 to 107;

Add claims 108 to 167, as follows:

1 108. A method of serving draught beverage in an open-
2 topped vessel, said beverage comprising a water content and
3 a dissolved gas content, and said method comprising cooling
4 the beverage to a temperature below the freezing point of
5 water at ambient atmospheric pressure, and delivering the
6 cooled beverage into said vessel, said cooled beverage
7 being subjected to at least one effect selected from the
8 group of effects consisting of the effect of ultrasound
9 signals, the effect of ice nucleation means and the effect
10 of gas bubble nucleation means.

1 109. A method according to Claim 108, wherein the
2 ultrasound signals are applied externally of said vessel.

1 110. A method according to Claim 108, wherein the
2 ultrasound signals are applied internally of said vessel to
3 the cooled beverage.

1 111. A method according to Claim 108, wherein an
2 ultrasound signal emitter is disposed in the beverage in
3 the vessel emitting ultrasound signals into the beverage in
4 the vessel.

1 112. A method according to Claim 108, wherein a dispense
2 outlet from which beverage is delivered into said vessel is
3 adapted for acting as an ultra-sonic emitter to provide
4 aforesaid ultrasound signals.

1 113. A method according to Claim 112, wherein aforesaid
2 ultrasound signals are applied to aforesaid beverage
3 flowing through the dispense outlet.

1 114. A method according to Claim 108, wherein the
2 ultrasound signals have a frequency in the range of 20kHz
3 to 70kHz.

1 115. A method according to Claim 108, wherein ice is
2 formed in the beverage from water of said water content.

1 116. A method according to Claim 115, wherein the beverage
2 in said vessel has a head of foam.

1 117. A method according to claim 116, wherein a mass of
2 said ice develops downwards in the beverage below the head.

3 118. A method according to claim 115, wherein the beverage
4 is a draught alcoholic beverage.

1 119. A method according to claim 118, wherein the
2 alcoholic beverage is any one selected from the group
3 consisting of a beer and cider.

1 120. A method according to claim 119, wherein the beverage
2 is a lager.

1 121. A method according to claim 108, wherein which the
2 vessel is chilled before beverage is delivered thereinto.

1 122. A method according to claim 121, wherein the vessel
2 is chilled to a temperature below substantially 4°C.

1 123. A method according to claim 108, wherein the beverage
2 is cooled to a temperature between substantially -1°C and
3 substantially -12°C.

1 124. A method according to claim 108, wherein the beverage
2 is cooled to a temperature between substantially -4°C and
3 substantially -6°C.

1 125. A method according to claim 109, wherein the
2 ultrasound signals are accompanied by at least one
3 phenomenon selected from the group of phenomena consisting
4 of a mechanically produced audible performance, an
5 electrically produced audible performance, a visible light
6 display and illumination.

1 126. A method according to claim 125, wherein the audible
2 performance is a musical sound.

1 127. A method according to claim 125, wherein the visible
2 light display comprises flashes of light.

1 128. A method according to claim 115, wherein the vessel
2 has an internal surface formed for providing nucleation
3 sites in the beverage for promoting formation of said ice.

1 129. A method according to claim 115, wherein said ice
2 comprises slush.

1 130. A beverage in an open topped vessel, said beverage
2 comprising a water content and a dissolved gas content, and
3 in said vessel the beverage has ahead of foam over ice,
4 said ice being formed in the beverage from water of said
5 water content.

1 131. A beverage according to claim 130, wherein the
2 beverage is a draught alcoholic beverage.

1 132. A method of keeping an alcoholic beverage in an open-
2 topped vessel cool said beverage comprising a water content
3 and a dissolved gas content, and said method comprising
4 forming ice on the beverage in the open-topped vessel
5 having a cooling effect on the beverage, said ice being
6 formed in the beverage from water of said water content.

1 133. A method according to Claim 132, wherein the beverage
2 is a draught beverage.

1 134. A method of sustaining cooling ice in a beverage in
2 an open-topped vessel, said beverage comprising water
3 content and a dissolved gas content, and wherein said ice

4 is formed in the beverage from water of said water content,
5 said method comprising providing a head of foam on the
6 beverage whereby in the vessel said ice is covered by the
7 head which acts as heat insulation above the ice against
8 heat directed towards the ice from above the head.

1 135. A method according to Claim 134, wherein the beverage
2 is a draught alcoholic beverage.

1 136. A method of sustaining a head on a beverage in an
2 open-topped vessel, said beverage comprising a water
3 content and a dissolved gas content, said method comprising
4 providing said head on the beverage and forming ice in the
5 beverage from water of said water content, and in said
6 vessel said ice having a cooling effect on the head from
7 below an upper part of the head.

1 137. A method according to Claim 136, wherein the beverage
2 is a draught alcoholic beverage.

1 138. An open-topped vessel of a beverage, the beverage
2 comprising a water content and a dissolved gas content and
3 being able to form a head as the beverage is dispensed into
4 the vessel, the vessel of beverage having a head overlying
5 an ice formation made of many ice crystals, the ice
6 formation having been produced by ice forming in the
7 beverage in any time period selected from the group of time
8 periods consisting of a time period occurring as the

9 beverage was dispensed and a time period occurring after
10 the beverage was dispensed into the vessel.

1 139. An open-topped vessel of a beverage according to
2 Claim 138, wherein the beverage is a draught alcoholic
3 beverage.

1 140. An alcoholic beverage comprising a water content and
2 a dissolved gas content wherein prior to being drunk said
3 beverage is cooled to a temperature below the freezing
4 point of water at ambient atmospheric pressure and
5 delivered in a container for drinking exposed to ambient
6 atmospheric pressure, and wherein in said container
7 aforesaid gas bubbles out of the beverage and at least a
8 portion of said water content becomes ice.

1 141. An alcoholic beverage according to Claim 33 wherein
2 the beverage is a draught beverage.

1 142. An alcoholic beverage to be available on draught and
2 comprising a water content and a dissolved gas content,
3 wherein prior to being drunk the draught beverage is to
4 issue, at a temperature below the freezing point of water
5 at ambient atmospheric pressure, from an outlet into an
6 open-topped vessel open to ambient atmospheric pressure so
7 that the aforesaid gas bubbles out of the beverage and at
8 least a portion of said water content becomes ice.

1 143. A method of serving a draught alcoholic beverage
2 which comprises a water content and a dissolved gas

3 content, and said method comprising issuing the draught
4 beverage from an outlet into an open topped vessel, prior
5 to said issuing storing or handling the beverage in a
6 manner which impedes loss of aforesaid dissolved gas from
7 the beverage and cooling said beverage to a temperature
8 below the freezing point of water at said ambient
9 atmospheric pressure, and in said vessel aforesaid gas
10 bubbles out of the beverage and at least a portion of said
11 water becomes ice.

1 144. A method of providing a visual display within an
2 open-topped vessel having at least a portion of wall of
3 some transparency, said method comprising providing a
4 draught alcoholic beverage comprising a water content and a
5 dissolved gas content, issuing the draught beverage from an
6 outlet into a said vessel, prior to said issuing, storing
7 or handling of the beverage which impedes loss of aforesaid
8 dissolved gas from the beverage and cooling said beverage
9 to a temperature below the freezing point of water at said
10 ambient atmospheric pressure, a visual display developing
11 in the beverage in the vessel, said visual display
12 comprising aforesaid gas bubbling out of the beverage and
13 formation of ice due to at least a portion of said water
14 becoming ice.

1 145. Apparatus for supplying a draught beverage,
2 comprising beverage cooling heat exchange means, a beverage

3 outlet for cold beverage from said heat exchange means to
4 issue from the outlet, openable and closable valve means
5 for controlling supply of beverage to said outlet, and a
6 beverage circulation loop for beverage to circulate in said
7 loop.

1 146. Apparatus according to Claim 145, wherein the
2 apparatus is arranged for the beverage to circulate in said
3 loop when the valve means is closed.

1 147. Apparatus according to Claim 145, wherein said loop
2 comprises pump means for circulating beverage in the loop.

1 148. Apparatus according to Claim 145, wherein said loop
2 includes a beverage flow passage in said heat exchange
3 means.

1 149. Apparatus according to Claim 145, wherein a beverage
2 flow path connects a reservoir of said draught beverage to
3 said heat exchange means.

1 150. Apparatus according to Claim 149, wherein said flow
2 path divides into a plurality of beverage routes, and said
3 loop comprises at least one of said routes.

1 151. Apparatus according to Claim 145, wherein the
2 apparatus is arranged for operation whereby the beverage
3 which emerges from said outlet is at a temperature below
4 the freezing point of water at the ambient atmospheric
5 pressure.

1 152. Apparatus according to Claim 145, wherein the
2 apparatus is arranged for operation whereby the beverage
3 which emerges from said outlet is at a temperature of
4 between substantially -1 C and substantially -12°C.

1 153. Apparatus according to Claim 145, wherein the
2 apparatus further comprises means to emit illumination.

1 154. Apparatus according to claim 145, for supplying
2 draught alcoholic beverage.

1 155. Apparatus according to claim 154, for supplying an
2 alcoholic beverage selected from the group consisting of
3 beer and cider.

1 156. Apparatus according to claim 155, wherein said beer
2 is a lager.

1 157. A method of serving draught cider in an open-topped
2 vessel and wherein said cider comprises a water content and
3 a dissolved gas content, said method comprising cooling the
4 cider to a temperature below the freezing point of water at
5 ambient atmospheric pressure, and delivering the cooled
6 cider into said vessel, said cooled cider being subjected
7 to the effect of ultra-sound signals.

1 158. A method according to claim 157, wherein said cider
2 is cooled to a temperature in the range of substantially
3 -1°C to substantially -12°C.

1 159. A method according to claim 157, wherein said cider
2 is cooled to a temperature of substantially -6°C.

1 160. A method according to claim 157, wherein said open-
2 topped vessel is chilled before receiving the cider.

1 161. A method according to claim 157, wherein said ultra-
2 sound signals have a frequency in the range of
3 substantially 20kHz to substantially 70kHz.

1 162. A method according to Claim 157, wherein said ultra-
2 sound signals are applied eternally of said vessel to said
3 vessel.

1 163. A method according to Claim 157, wherein which said
2 ultra-sound signals are applied eternally of said vessel to
3 the cooled cider.

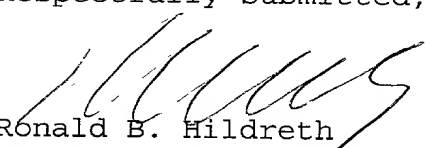
1 164. A method according to Claim 157, wherein a dispense
2 outlet from which the cooled cider issues into said vessel
3 is arranged for acting as an ultra-sonic signal emitter for
4 producing aforesaid ultra-sound signals.

1 165. Cider in an open-topped vessel wherein said cider
2 comprises a dissolved gas content and a water content, and
3 wherein said cider has a head of foam over ice, said ice
4 being formed in the cider from water of said water content.

1 166. A method of sustaining a head on cider in an open-
2 topped vessel wherein said cider comprises a dissolved gas
3 content and a water content, said method comprising a head
4 on the cider and forming ice in the cider from water of
5 said water content, and in said vessel said ice forming a
6 layer covered by said head.

- 1 167. Cider according to Claim 165, wherein said ice
- 2 comprises slush.

Respectfully submitted,



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Druckexemplar

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A BEVERAGE

This invention relates to a beverage, to methods of presenting or serving a beverage, to providing a visual display in a beverage, and to
5 apparatus to supply draught beverage.

The beverage concerned comprises a water content and a dissolved gas content.

10 The beverage may be an alcoholic beverage or a non-alcoholic beverage. For example, the beverage may be a beer, a cider, a flavoured alcoholic beverage, for example an alcoholic lemonade or other alco-pop style of drink, or a so-called low alcoholic drink. The term "beer" embraces lager, ale, porter and stout and includes a beverage comprising
15 hops flavouring, an alcohol content derived from malt and fermentation, a water content, and a dissolved gas content.

One object is to provide a cool beverage using ice therein in a way which a consumer may find more agreeable because dilution of the drink
20 cannot occur.

Another object to provide a beverage which the existence of cooling ice therein may be sustained whereby the drink may be kept cold for an extended period of time.

25

Another object is to provide a beverage in which a head thereon may be sustained.

Another object is to provide a beverage in which ice may develop
30 therein as an interesting visual display.

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According to a first aspect of the invention there is provided a beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and in said vessel the beverage
5 having a head of foam over ice, said ice being formed in the beverage from water of said water content.

The vessel may be any suitable vessel, for example a drinking vessel, for example a glass.
10

Preferably there is a layer of ice adjacent the head, in contact with the head. Preferably there is a projection of ice extending downwards, away from the head, and being provided in the region of the head. The projection of the ice may depend directly from the head, or from a layer
15 of ice beneath the head.

The ice is preferably made of many small crystals of ice, rather than a single solid mass. The ice is preferably slushy in character, rather than being a solid mass. There may be more than one kind of ice
20 formation in the beverage. There may be a fine, powdery ice. There may be a flaky ice, of the order of 1 or 2mm or 3mm or 4mm, or more, in their longest dimension of the flakes.

The beverage, which may be coloured as distinct from white or
25 water clear, may have bands, or stripes, across it at different heights, the bands possibly being white layers where nucleation is taking place, and beverage-coloured layers interposed between the white layers where less nucleation is taking place. This effect may be achieved by using ultrasound on the vessel, for example a glass, of beverage. The white

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bands and the interposed beverage-coloured bands may be of substantially the same thickness.

5 The white bands interspersed by beverage-coloured bands may exist for a matter of seconds, rather than minutes, and typically exist for 1 to 10 seconds, preferably about 3 to 6 seconds. The white bands/beverage-coloured bands interspersed may exist for substantially the same time as ultrasound is applied to the vessel of beverage.

10 Nucleation means may be provided to encourage the formation of the ice crystals and/or head in the beverage when it is in a vessel. The nucleation means is preferably the administration of ultrasound, preferably to the bottom portion of a vessel of beverage, but it could be other forms of nucleation inducement. For example the vessel and/or
15 dispense tap/nozzle (or an object to be inserted into the vessel of beverage) may have a roughened surface/high surface area surface to encourage nucleation (such as a sintered surface, etched surface, or a surface of ground material, such as glass); or a rapid and suitably large pressure drop may be provided to induce nucleation; or mechanical
20 agitation may be provided; or the beverage may be arranged to have turbulent flow to promote nucleation; or an amount of liquid, possibly highly supersaturated with gas, may be introduced or injected; or gas may be otherwise introduced, or injected, or the glass may be vibrated in some way (e.g. by being exposed to sound waves, or the vessel may be vibrated
25 in some other way); or by introducing a chemical (e.g. tablet) or device which generates bubbles (for example a chemical pellet may effervesce or dissolve, releasing bubbles).

30 According to a second aspect of the invention there is provided a method of keeping an acholic beverage in an open-topped vessel cool, said

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beverage comprising a water content and a dissolved gas content, and said method comprising forming ice in the beverage in the open-topped vessel having a cooling effect on the beverage, said ice being formed in the beverage from water of said water content.

5

According to a third aspect of the invention there is provided a method of sustaining cooling ice in a beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and wherein said ice is formed in the beverage from water of said water content, said method comprising providing a head of foam on the beverage such that in the vessel said ice is covered by the head which acts as heat insulation above the ice against heat directed towards the ice from above the head.

10

According to a fourth aspect of the invention there is provided a method of sustaining a head on beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, said method comprising providing a head on the beverage and forming ice in the beverage from water of said water content, and in said vessel said ice having a cooling effect on the head from below an upper part of the head.

15

20

According to a fifth aspect of the invention, there is provided an open-topped vessel of a beverage the beverage comprising a water content and a dissolved gas content and being able to form a head as the beverage is dispensed into the vessel, the vessel of beverage having a head overlying an ice formation made of many ice crystals, the ice formation having been produced by ice forming in the beverage as it was dispensed or after it was dispensed into the vessel.

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Preferably the vessel has a transparent or translucent wall or at least has a window of transparent or translucent material.

5 Preferably the ice formation extends substantially the width of the mouth of the vessel, or completely across the width of the mouth. It may comprise substantially homogenous ice-crystals in a head-contacting region or layer. Alternatively, the ice crystals that contact the head may not be substantially homogeneous.

10 The ice formation may have a projection extending away from the head. The projection may comprise flakes of ice that are larger than the ice at the ice-head boundary.

15 The ice at the ice-head interface may have been formed before the ice flakes of the projection.

20 The beverage may have been subjected to ultrasound signals and may be draught beverage delivered into the vessel. Before the draft beverage is delivered into the vessel, and preferably immediately before, the beverage may be cooled to a temperature below the freezing point of water at ambient atmospheric pressure.

25 According to a sixth aspect of the invention there is provided a method of serving draught beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and said method comprising cooling the beverage to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled beverage into said vessel, said cooled beverage being subjected to the effect of ultrasound signals or to the effect of other ice and/or gas
30 bubble nucleation means.

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The ultrasound signals may be applied externally of said vessel, and/or the ultrasound signals may be applied internally of said vessel to the cooled beverage. In the latter case an ultra-sonic emitter provided as
5 or incorporated into a probe may be disposed in the beverage in the vessel. If desired a dispense outlet or nozzle from which the beverage is delivered into the vessel may be adapted to act as an ultra-sonic emitter to provide aforesaid ultrasound signals to beverage in the vessel. Such signals may be applied to the beverage as it passes through the dispense
10 outlet.

Ultrasound signals can be applied to beverage not only after it has been delivered into the vessel, but also whilst it is being delivered.

15 The ultrasound signals may have a frequency in the range of 20kHz to 70kHz. For example, the ultrasound signals may have a frequency of substantially 30kHz.

A mass of aforesaid ice may develop downwards in the beverage
20 below the head.

Preferably, the vessel is chilled before the beverage is delivered thereinto. The vessel may be chilled to a temperature of substantially 4°C, or the vessel may be chilled to a temperature less than 4°C. For
25 example, the vessel may be chilled to a temperature of substantially 0°C.

Prior to the delivery, and preferably just prior to the delivery, a draught beverage may be cooled to a temperature in a range of between substantially -1°C and substantially -12°C and may issue at a temperature
30 substantially in that range into the vessel. If desired, the beverage may be

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cooled to a temperature between substantially -4°C and substantially -6°C . The greater the alcohol strength by volume (abv), the lower the temperature to which the alcoholic beverage may be cooled. We may aim to achieve a dispense temperature of about -5°C for a lager (or other
5 drink) with about 4.5 abv (or to substantially -4°C or substantially -6°C).

Preferably, the vessel has a wall portion of sufficient transparency to allow the contents of the vessel to be visible through said wall portion. Thus the vessel may be a glass drinking vessel.
10

Preferably the beverage is a pale colour for example the colour of a pale beer. If desired the beverage can be a lager, or a cider.

Aforesaid dissolved gas may comprise carbon dioxide and/or may
15 comprise nitrogen. A dissolved nitrogen content in the beverage, for example an alcoholic beverage may be in the range of substantially zero parts per million (p.p.m) to substantially 100 p.p.m. For some beverages, for example certain lagers, substantially 40 p.p.m. A dissolved carbon dioxide content may approach zero % by volume or be
20 greater. Said carbon dioxide may be substantially at any of the following levels or in a range defined between any of the following levels; zero vols/vol, 0.5 vols/vol, 1 vols/vol, 1.4 or 1.5 vols/vol, 2.0 vols/vol, 2.2 or 2.4 vols/vol, 3 vols/vol, 4 vols/vols or 5 vols/vol or above.

25 If desired, the ultrasound signals can be accompanied by a mechanically or electrically produced audible performance and/or a visible light display. The audible performance may be tuneful or musical sound. The visible light displays may comprise visible flashes of light.

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If desired the beverage can be subjected to the ultrasound within an enclosure arranged to conceal the vessel from view from at least one side of said enclosure.

- 5 According to a seventh aspect of the invention, there is provided an alcoholic beverage comprising a water content and a dissolved gas content, wherein prior to being drunk said beverage is cooled to a temperature below the freezing point of water at ambient atmospheric pressure and delivered in a vessel to be drunk exposed to ambient
- 10 atmospheric pressure, and wherein in said vessel aforesaid gas bubbles out of the beverage and at least a portion of said water content becomes ice.

- According to an eighth aspect of the invention, there is provided an alcoholic beverage to be available on draught and comprising a water
- 15 content and a dissolved gas content, wherein prior to being drunk the draught beverage is to issue, at a temperature below the freezing point of water at ambient atmospheric pressure, from an outlet into a vessel open to ambient atmospheric pressure so that aforesaid gas bubbles out of the beverage and at least a portion of said water content becomes ice.

20

- If desired, the vessel which preferably may be a drinking vessel, can have a shape or formation to promote formation of the ice. For example, the vessel may have an internal surface to provide nucleation sites to promote formation of the ice. Said surface may have at least a
- 25 surface portion which is roughened. At least a wall portion of vessel can be arranged to change colour automatically with variation in temperature. Said wall portion may comprise thermo-chromic material.

- Desirably, the gas is a non-oxidising gas. This can avoid or at
- 30 least slow deterioration of the beverage. The gas comprises carbon

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dioxide and/or nitrogen. By cooling the beverage and forming ice therein, this appears to, initially at least, reduce the rate of release of dissolved gas from the beverage, for example lager, and appears to improve the drinking sensation, taste, flavour or bite. We believe that
5 this is a combination of the low drinking temperature (maintained by the ice) and the greater amount of retained gas in the beverage.

The presence of the ice can provide an interesting and attractive feature which can be particularly fascinating as the ice may expand at a
10 noticeable rate throughout the beverage after the vessel is filled. To add to the interest, the ice may include therein one or more streaks or regions of one or more colours which contrast(s) with the colour of the ice and/or beverage.

15 The aforesaid ice may be, or may have, the character of slush.

According to a ninth aspect of the invention, there is provided a method of serving a draught alcoholic beverage which comprises a water content and a dissolved gas content, said method comprising issuing the
20 draught beverage from an outlet into a vessel, prior to said issuing, storing or handling the beverage in a manner which impedes loss of the aforesaid dissolved gas from the beverage and cooling said beverage to a temperature below the freezing point of water at said ambient atmospheric pressure, and in said vessel aforesaid gas bubbles out of the beverage and
25 at least a portion of said water becomes ice.

According to a tenth aspect of the invention, there is provided a method of providing a visual display or effect within a vessel having at least a portion of wall of some transparency, said method comprising
30 providing a draught alcoholic beverage comprising a water content and a

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dissolved gas content, issuing the draught beverage from an outlet into a said vessel, prior to said issuing, storing or handling the beverage in a manner which impedes loss of aforesaid dissolved gas from the beverage and cooling said beverage to a temperature below the freezing point of
5 water at said ambient atmospheric pressure and a visual display or effect developing in the beverage in the vessel, said visual display or effect comprising aforesaid gas bubbling out of the beverage and formation of ice due to at least a portion of said water becomes ice.

10 Formation of ice can develop in the vessel so as to increase the amount and extent of the ice from substantially an upper level of the beverage downwards through the beverage.

At least a wall portion of the vessel may change colour
15 automatically with variation in temperature. Said wall portion may comprise thermo-chromic material.

An implement can be inserted into the beverage in the vessel to encourage formation of said ice. For example, the implement may be a
20 thermometer, or it may be a swizzle-stick.

Colouring material or dye can be provided to form at least one coloured streak or region in the beverage and/or ice, the colour of said material or dye being in contrast to that of the ice and/or beverage so as
25 to be visible.

The aforesaid implement may be used to add the colouring material or dye to the beverage and/or ice.

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In one method, the beverage may issue at substantially -4°C into the vessel and thereafter the temperature of the beverage in the vessel may rise almost immediately to at least substantially -3°C

5 According to an eleventh aspect of the invention, there is provided a beverage dispense apparatus comprising cooling means adapted to cool a beverage to below 0°C , a dispense tap, and beverage dispense pipework adapted to convey the beverage to the dispense tap, the arrangement being such that the apparatus is adapted to dispense the beverage cooled to
10 below the point at which ice would normally form in the beverage if the beverage were left standing at atmospheric pressure and if nucleation means were provided for the standing beverage, and in which the undispensed beverage in the apparatus does not freeze solid.

15 Preferably, the apparatus includes pump means and the beverage dispense pipework may include a portion which circulates beverage past the dispense tap when the dispense tap is closed, the fact that cooled undispensed beverage is kept flowing tends to prevent the formation of ice blockages at the dispense tap.

20

The beverage may be kept flowing past the dispense tap (or through it when it is open) at substantially all times that the beverage is at a temperature at which ice may otherwise form at the dispense tap or, in the beverage dispense pipework.

25

Preferably, there is a cold circulation loop in which is provided at least one cooling means and which is connected to the dispense tap, beverage in the circulation loop being kept cold by the cooling means and being kept circulating by pump means provided in the circulation loop.

30 There may be a plurality of cooling means (e.g. heat exchangers) in the

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circulation loop. There may be a plurality of dispense taps associated with the circulation loop.

5 Beverage upstream of the circulation loop may be cooled to a temperature about that at which ice may form in the beverage under the conditions of temperature and pressure experienced by the beverage in the pipework upstream of the circulation loop.

10 According to a twelfth aspect of the invention, there is provided apparatus to supply draught beverage, comprising beverage heat exchange means, a beverage outlet for cold beverage from said heat exchange means to issue from the outlet, openable and closable valve means to control supply of beverage to said outlet, and a beverage circulation loop for beverage to circulate in said loop.

15

The beverage can circulate in the loop when the valve means is closed. Preferably, the loop comprises pump means to circulate said beverage.

20 A purpose of circulating the beverage is to reduce the risk of or avoid freezing beverage blocking a beverage supply path to the outlet. Said loop may include a beverage flow passage in said heat exchange means.

25 In a preferred embodiment, the apparatus can comprise a unit or dispenser mountable on a counter of a drinks' bar and comprising the heat exchange means and the outlet.

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A beverage flow path can connect a reservoir of the draught beverage to the heat exchange means. The flow path may comprise at least a portion of the loop.

- 5 The flow path may divide into a plurality of beverage routes, and the loop may comprise one or more of the routes.

Intermediate the reservoir and the first-mentioned heat exchange means. The beverage may be subject to the effect of second beverage cooling heat
10 exchange means.

The reservoir may be subjected to cooling.

If desired, the second heat exchange means may act on at least a
15 portion of the loop.

Coolant common to the first and second heat exchange means may circulate therethrough.

20 Beverage cooling heat exchange means may act on the beverage intermediate said reservoir and loop.

One advantage of a specific embodiment of the invention is that it enables us to provide cool beverage using ice therein in a way which a
25 consumer may find more agreeable because dilution of the drink cannot occur. Another advantage may be that we can provide a beverage in which the existence of cooling ice therein may be sustained whereby the drink may be kept cold for an extended period of time.

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A further advantage may be that we can provide beverage in which a head thereon may be sustained for a longer period of time than is achieved by the same beer dispensed at, say 6°C, or at say 4°C using similar or the same dispense apparatus. Yet a further advantage of one
5 embodiment of the invention is that it enables us to provide beer in which ice may develop therein as an interesting visual display.

It is extremely difficult to serve a glass of draught cider with a head of froth or foam so that the head lasts for any appreciable time.
10 Though it is possible to create a head by dispensing the cider from a font containing a sparkler, the head quickly disappears. Because the use of a sparkler slows the delivery rate of the cider, it takes longer to deliver a measured volume than if the sparkler were not used, and because the head quickly vanishes anyway some people think use of a sparkler pointless and
15 take it off the font - sometimes without permission.

Another object is to provide a method of serving draught cider containing a dissolved gas content so that a head on the delivered draught cider in a vessel, for example a drinking glass, is more stable and remains
20 for a longer period of time than a head on cider served by hitherto known methods.

According to a thirteenth aspect of the invention, there is provided a method of serving draught cider in an open-topped vessel and wherein
25 said cider comprises a water content and a dissolved gas content, said method comprising cooling the cider to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled cider into said vessel, said cooled cider being subjected to the effect of ultra-sound signals.

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The cider may be cooled to a temperature in the range of substantially -1°C to substantially -12°C . For example, the cider may be cooled to substantially -6°C . The greater the alcohol strength by volume the lower the temperature to which the cider may be cooled.

5

If desired, the cooled cider may issue from a dispense outlet through a sparkler. However, the cooled cider may pass through an orifice plate in a dispense outlet from which the cider issues.

10

Preferably the open-topped vessel is chilled before receiving the cider. The vessel may be chilled to substantially 4°C or may be chilled to a temperature lower than 4°C . For example, the vessel may be chilled to substantially 0°C .

15

Said ultra-sound signals may have a frequency in the range of substantially 20kHz to substantially 70kHz. For example, the ultra-sound signals may have a frequency of substantially 30kHz.

20

The ultra-sound signals can be applied externally of said vessel to said vessel.

25

The ultra-sound signals may be applied internally of said vessel to the cooled cider. Thus an ultra-sonic signal emitter may be disposed in the cider in the vessel for emitting ultra-sound signals into the cider in the vessel.

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The dispense outlet from which the cooled cider issues into said vessel may be adapted to act as an ultra-sonic signal emitter to provide aforesaid ultra-sound signals. Aforesaid ultra-sound signals may be applied to aforesaid cider flowing through the dispense outlet.

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The dissolved gas content may comprise carbon dioxide and/or nitrogen. The carbon dioxide may approach zero % by volume or be greater, and/or the nitrogen content may approach zero parts per million (p.p.m.) or be greater for example, the carbon dioxide content may be substantially 1.8% by volume and/or the nitrogen content may be substantially 18 parts per million (p.p.m.).

According to the fourteenth aspect of the invention there is provided cider in an open-topped vessel wherein said cider has a dissolved gas content and water content, and wherein said cider has a head of foam over ice, said ice being formed from water of said water content. In said cider according to said fourteenth aspect of the invention, said head and ice may be produced at least in part by performance of said method according to the thirteenth aspect.

According to a fifteenth aspect of the invention there is provided a method of sustaining a head on cider in an open-topped vessel wherein said cider comprises a water content and a dissolved gas content, said method comprising providing a head on the cider and forming ice in the cider from water of said water content, and in said vessel said ice forming a layer covered by said head. In said method according to the fifteenth aspect of the invention, said head and ice may be produced at least in part by performance of said method according to the thirteenth aspect.

The invention will now be further described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a diagrammatic view of apparatus for delivering cooled draught beverage;

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Figures 2 to 4 show diagrammatically in elevation a drinking vessel filled with draught beverage delivered by the apparatus in Figure 1 to illustrate successive changes or variations in the beverage after delivery thereof into a drinking vessel;

Figure 5 to 7 respectively shows diagrammatic side elevations illustrating modifications in the way the delivered beverage may be served in the drinking vessel;

10

Figure 8 is a diagrammatic view showing in elevation a drinking vessel filled with a beverage delivered by the apparatus in Figure 1, the vessel being shown standing on apparatus represented diagrammatically to apply ultrasound signals to the beverage;

15

Figures 9 to 15 show diagrammatically in elevation successive changes in the development or variations in a head on the beverage subsequent to the beverage being subjected to ultrasound signals and also to development or variation in ice formed in the beverage;

20

Figure 16 is a diagrammatic view of an alternative method of applying ultrasound signals to the beverage;

Figure 17 is a diagrammatic view of yet a further method of applying ultrasound signals to the beverage;

25

Figure 18 shows a pint of lager being excited by ultrasound;

Figure 19 shows the pint of lager in Figure 18 after it has been allowed to stand for three minutes;

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Figure 20 is a diagrammatic view of apparatus for delivering cooled draught cider;

5 Figure 21 is a diagrammatic view showing in elevation a drinking vessel filled with cider delivered by the apparatus in Figure 20, the vessel being shown standing on apparatus represented diagrammatically (and similar to that in Figure 8) to apply ultra-sound signals to the cider;

10 Figure 22 and 23 shows diagrammatically in elevation successive changes in the development of the variations in the head on the cider subsequent to the cider being subjected to ultra-sound signals and also to development of or variations in ice formed in the cider;

15 Figure 24 is a diagrammatic view of an alternative method of applying ultra-sound signals to the cider, and;

Figure 25 is a diagrammatic view of yet a further method of applying ultra-sound signals to the cider.

20

The draught beverage is stored in a keg or cask 4 which may be made of metal. The cask 4 can be stored in a cold-room known per se in public houses or clubs and/or, if desired, in a more specific cold or cooled enclosure 6, for example a tank containing a chilled mixture of
25 water and ethylene glycol. As stated above the beverage has a water content and a dissolved gas content. This gas may be any suitable non-oxidising gas, for example carbon dioxide and/or nitrogen. The amount of gas dissolved in the beverage may be within the usual known range for beverages, and the pressure within the cask 4 and the remainder of the

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supply apparatus (described below) may also be within the usual known range for beverages supplied on draught.

The beverage may be a beer which term includes lager, ale, porter, or stout, or may be cider. The dissolved carbon dioxide content may be greater than substantially 1 vols/vol or 2 vols/vol and may be substantially 2.2 volumes per volume, and/or the dissolved nitrogen content may be substantially 25 p.p.m. to 35 p.p.m. If desired the carbon dioxide content may be substantially 4 vols/vol or substantially 5 vols/vol. The alcohol content may be between 2.5% abv to 6 or 7% abv, preferably 4.5% abv, $\pm 1\%$ abv.

The beverage may be a flavoured alcoholic beverage.

A pump 8, arranged to operate substantially only when the manually operable valve 10 is open, is provided to pump beverage from the cask 4 along a pipe 12 ultimately to the valve 10 and a dispense outlet 14 therefrom. In known manner, a blanket or atmosphere of non-oxidising/pressurised gas (for example carbon dioxide and/or nitrogen) is provided in the cask 4 from a suitable supply 16 and assists the pump 8 in the extraction of the beverage.

A beverage dispense unit is indicated generally at 18 and has a cover indicated by interrupted lines 20. The dispense unit may be mounted at or in the vicinity of a drinks' bar - for example on the top of, or incorporated into, a counter of the bar.

In proximity to the cover 20 the pipe 12 divides into two flow paths 22 and 24, each leading to the valve 10. One is formed by piping 22a, 22b, 22c and passages 26 in heat exchangers 28a and 28b, and the other is

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formed by piping 24a, 24b, 24c and passages 26 in heat exchangers 28c and 28d.

5 A chiller unit 30 circulates coolant through passages 32 in the heat exchangers 28 in the series by a system comprising a coolant flow pipe 34 and a coolant return pipe 36. Beverage pipes 22a and 24a can be bundled together in known manner with the coolant pipes 34 and 36 to form a python 38. The heat exchangers 28 may be plate heat exchangers.

10 A circulation pump 40 which may operate continuously, extends between the flow paths 22 and 24 adjacent to the junction between the pipe 12 and the flow paths. Thus, the flow paths 22, 24 and the pump 40 form a circulation loop 22, 24, 40 around which beverage is continuously circulated when valve 10 is closed.

15 As suggested in Figure 1, in the beverage dispense unit 18, the heat exchangers 28 are within the cover 20, whilst the valve 10 and outlet 14 can be on its exterior, and a portion of the circulation loop comprised by the pump 40 and sections of pipes 22a and 24a is also external of the cover and may be exposed to ambient temperature at the bar.

20

If desired, the pipe 12 may be incorporated in know manner into another cooling python 42 comprising flow and return pipes 44 and 46, carrying coolant from and back to a chiller unit 48.

25 Overall, the beverage arrangement - and particularly that provided by the dispense unit 18 by the heat exchangers 28 - so cools the beverage that the beverage issuing from the outlet 14 when valve 10 is opened is at a temperature below the freezing point of water at the ambient atmospheric pressure. For example the beverage may issue at a
30 temperature in the range of substantially -1°C to substantially -12°C into

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a drinking vessel or drinking glass. The range may be substantially -4°C to substantially -6°C . A target temperature of -5°C is aimed for if we use a beverage with about 4.5% abv.

- 5 When the valve 10 is closed, the beverage is circulated automatically around the loop 22, 24, 40 so it cannot stand still and start to freeze and block the supply path to valve 10.

- 10 In the case of draught beverages, for example beers, conventionally served with a head, the outlet 14 may include a known orifice plate, or other device, to promote foaming.

- 15 With reference to Figure 2, when a draught beverage 50 is delivered from the outlet 14 (Figure 1) into a drinking vessel 52 (for example a glass) the beverage is exposed to ambient atmospheric pressure and ambient or room temperature, the beverage temperature starts to increase, for example to -3°C . Almost immediately, a slug of ice 54a forms near the top of the vessel 50 at the upper level of the beverage, the ice being caused (we believe) as a result of nucleation sites resulting from the forming of bubbles of dissolved gas. If the beverage 50 has a head 56 of foam the ice forms just below the head. The or a greater part of the ice may be in the nature of slush and is formed from the water already forming the beverage. The slug of ice grows as indicated at 54b in Figure 3 and 54c in Figure 4 until it may substantially occupy the vessel 20 52. The growth of ice (in, say, a pint glass) can be accomplished in a minute or two, is fascinating to watch and can give rise to interesting visual effects based on the growth of the ice and the bubbling off of the gas. Another interesting visual effect is that cooled beverages delivered into a drinking vessel from the apparatus in Figure 1 swirl in the vessel 25 for a longer time period than beverages which have not been cooled.
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Not only does the formation of the ice give rise to interesting visual effects, but the existence of the ice helps to keep the drink cool longer. Also, since the ice is formed from the water in the beverage, the beverage is not diluted by the ice. In fact, for an alcoholic beverage, the overall amount of alcohol remains the same in the container when the ice forms, but since water is being used for the ice, the alcoholic strength of the remaining liquid beverages increases until the ice melts.

The vessel 52 may be shaped or formed to encourage formation of the ice. In Figure 5, a region 58 (having a rough surface) is provided to encourage formation of nucleation sites to promote formations of a further ice slug 54d which rises as indicated by arrow A to enlarge the ice slug 54 developing from the top of the vessel 52.

In Figure 6, formation of further ice 54e in the body of the beverage 50 is encouraged by the insertion therein of an elongate implement or rod 60 represented in Figure 6 by a swizzle-stick having formations 62 and 64 at its lower end and shank respectively which further encourage development of nucleation sites. In another instance, the rod 60 may be a thermometer body which can also be used to take the temperature of the drink to see if it has risen sufficiently high for it to be safe to drink. The implement can be used to push the ice around.

In Figure 7, coloured regions or streaks are shown in the ice 54 and beverage 50. These coloured formations are formed by the release of non-toxic, edible, colouring materials or dyes into the beverage 56. The colouring material or dye, which stands out visually from the ice and beverage, may be injected into the beverage, or may be introduced into the beverage by or on the aforesaid implement.

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It is preferable for the vessel 52 to have a wall of sufficient transparency so that the formation of the ice slug 54 in the beverage 50 can be observed and its changing nature visually appreciated.

5

The drinking vessel 52 can be formed of, or have external surface areas formed of, material (for example thermo-chromic material) which automatically changes colour with temperature change. Apart from this being a further interesting visual effect, the attainment of one particular colour may signal that the beverage is at a suitable temperature for drinking.

10

Whilst any kind of beverage having a water and dissolved gas content may be used, we believe that lager demonstrates a visual nature or character of the invention.

15

With reference to Figure 8, a draught beverage 70 (which may be a beer, for example a lager) is delivered from the outlet 14 (Figure 1) into a drinking vessel 72, for example a glass which is preferably rather tall and preferably has a clear or transparent wall.

20

Preferably, the vessel 72 is chilled before it received the beverage. The vessel 72 may be chilled to a temperature of substantially 4°C or less. For example a known bottle chiller may be used to chill the vessel 72 to substantially 4°C whilst a known glass froster may chill the vessel to substantially 0°C. A head of foam is shown at 74 and preferably this is some way below the top of the vessel 72 when the vessel contains a full measured volume, for example a pint of the beer.

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Immediately after the cold beverage is poured into the chilled vessel 72 (or a few seconds after), the vessel is placed in a shallow depth of water 76 in a dish part 78 of an ultrasound generating apparatus 80 in which the dish 78 is securely mounted or affixed against a base part 82
5 containing an ultrasonic emitter 84. The emitter 84 may be arranged to emit ultrasound signals in a frequency range of substantially 20kHz to 70kHz. For example the beverage may be subject to ultrasound signals of a frequency of substantially 30 kHz or some other frequency selected from the aforesaid range, the water layer 76 providing an ultrasound for any
10 desired period, though usually a short period of a few seconds, for example substantially one to five seconds and more specifically about three or four seconds. The user may be able to vary the length of time that the ultrasound is applied, for example by having to hold down a switch, or by altering the setting on a control.

15

The result in a short time (perhaps a few seconds to the order of ten seconds) is shown in Figure 9 in which the exposure to ultra-sonic signals has promoted a fairly dense sudden formation of a mass of bubbles 86 of the dissolved gas throughout the liquid beverage. This causes the
20 head 74 to increase in height. As shown in Figure 10, the head 74 may rise out of the vessel 72. The gas bubbles form nucleation sites encouraging the quick formation of a mass of ice 88A just below the head. This ice 88A may be of a rather slushy character. For a period the mass of slush 88A grows and the head 74 rises as shown in Figure 11 but the
25 bubbles of gas are no longer so numerous. Nevertheless, they can act as nucleation sites encouraging thereat the formation of ice 88B in the body of the beverage, this ice 88B may be more in the nature of flakes, for example snow type flakes, which rise and agglomerate to form a flaky mass 88C of ice on the underside of the slushy ice mass 88A. As

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indicated in Figure 12 and 13 the ice flakes continue to form for a period, rise and extend the ice mass 88C downwards through the beverage 70.

5 Going from the stage shown in Figure 8 to that in Figure 14 may only take one or two minutes so the increase in gas bubbling and the formation and visible development of the ice takes place fairly quickly and can be an interesting and rather amazing phenomena to observe through the glass 72.

10 To enhance the theatre, drama or wonder of the event for a customer at the drinks' bar the operation of the apparatus 80 may be accompanied by an automatically (or manually actuated) occurring audible performance which may be mechanically or electrically produced using sound apparatus giving out dramatic, musical or tuneful sounds. In
15 addition to, or as an alternative, the operation of the apparatus 80 may be, possibly automatically, accompanied by a visual lights display, for example visible flashes of light. These may stimulate flashes of lightening. In that case the audible performance may comprise noise resembling thunder.

20

 If desired, the vessel 72 when subject to the ultrasound may be concealed from the view of the customer in a bar. For example, it may be concealed from view on one or more sides in an enclosure which may be on the counter or proximate thereto, which enclosure may be represented
25 as a "magic" or magician's box or cabinet.

 Preferably, the beverage is a pale colour. For example the beverage may be a pale coloured beer, for example a lager.

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Besides the ice forming in the beverage 70 being an intriguing sight, it helps show the customer the beverage is cold and that it has not been diluted by addition of ice from water other than that of the beverage.

5 The good head 74 provides insulation of the ice, particularly from overhead heat, which helps sustain the ice for longer and thus the duration of its cooling effect. Also the ice below the head 74, helps sustain the existence of the head which may last for ten minutes, fifteen minutes or most preferably for twenty minutes or so.

10

In Figure 15, the head 74 though starting to collapse (at its centre and move away from the vessel's wall) after the elapse of some time, for example fifteen or so minutes, is still stubbornly remaining, insulating the ice and giving the beverage an attractive presentation in the vessel 72.

15

An alternative method of applying the ultrasound signals is represented in Figure 16 in which after the apparatus 2 in Figure 1 has dispensed a vessel or glass 72 of beverage 70 an ultrasound probe 90 powered through cable 92 is dipped into the beverage for emitter 84A to give out ultrasound signals. The probe 90 may be inserted into the beverage before the full measured amount is supplied to the vessel.

20

In Figure 12, the dispense outlet 14 has been arranged to act as an ultrasonic probe, for example by providing it with an ultrasonic emitter 88B.

25

The ultrasound probe 14 in Figure 12 may emit ultrasound signals whilst beer is passing through it to the vessel 72, and/or may become partially immersed in the beverage as shown and emit ultrasound signals

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into the beverage 70 in the vessel 72 whilst the measured volume of beverage is still being supplied or after it has been supplied. ..

Figure 18 shows another glass 172 (for example a pint) of beverage 170 in this case lager, being excited (as indicated by arrow X) at the base only by an ultrasound emitter, for example by standing the glass of beverage in couplant (water) for example as shown in Figure 8. Figure 18 shows the glass 172 after it has been excited by the ultrasound for about three seconds or so, and whilst it is still being excited by ultrasound and whilst a head 174 of foam is beginning to form. As will be seen, in addition to general bubble formation at a relatively modest level throughout the volume of the beverage 170, there is increased activity in a series of horizontal "white bands" about half-way up the height of the glass 172. Interspersed between the white hands 120 are bands 122 which are less white-coloured i.e. more beerage or lager coloured. There are typically two to four white bands 120 visible, but increased bubble formation may occur above and below the "banded region" 120, 122.

The formation of the bands 120, 122 gives the glass of beverage an attractive appearance for the few seconds that they last. It is believed that they may be associated with the formation of standing waves in the glass 172 due to the ultrasound excitation, and may represent areas of the glass which might vibrate the most (although this belief is speculative and is not to be held to be limiting). The bands 120, 122 may form generally in the central height of the glass, but they may not be right at the middle - for example, they could be one-third to two-fifths of the way down from the top (or up from the bottom).

It should also be noted that the glass 172 of Figure 18 has a mouth 124 that is narrower than a body portion 126. It is believed that having a

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restricted mouth forms a deeper and longer-lasting head. This may, or may not be associated with the fact that in comparison with the volume of beer contained a glass with a restricted mouth has a smaller exposed surface area of head than if it were in a vessel with straight sides, or

5 outwardly flared sides.

Our trials indicate that best/better results can be achieved on pints of beverage than on half-pints of beverage. This may be associated with greater heat capacity of a pint of beverage in comparison with a half-pint

10 of beverage, and the less effect exposure to the environment has/the less rapid the effect of the heat transfer to the local environment, when the ratio of volume of beverage; exposed surface is larger.

Figure 19, illustrates the pint of lager of Figure 18 after about

15 three minutes have expired (or looked at another way after about ten minutes have expired - there is little change in the appearance of the glass of lager between the three minutes and the ten minutes). The head 174 is somewhat deeper than might be expected, and slightly projects above the glass 172. There is a relatively thin layer of ice 188A (of the order of a

20 half to a few millimetres) extending under the head completely across the diameter of the glass 172 and there is a depending projection of flaky ice 188B extending down perhaps two to five centimetres into the cleared beer. The projection 188B may extend for at least three centimetres, five centimetres is not to be taken as necessarily an upper limit to its length.

25 The projection 188B is generally central, but may be off-axis in comparison with the central axis of the glass. It has a narrower tip than it does base (the base being the portion adjacent the head 174).

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It will be appreciated that creating a beverage having such an ice formation is in itself new and itself gives a visually differentiated product - which is desirable to consumers.

5 Moreover, creating the bands or stripes during ultrasonic excitation of the glass of beverage also creates a visually distinct product, and a differentiated mode of provision of the product to the consumer.

10 With reference to Figure 20 apparatus to supply cider on draught is indicated at 202.

The draught cider is stored in a keg or cask 204. As stated above, the draught cider has a water content and a dissolved gas content.

15 This gas may be any suitable non-oxidising gas, for example carbon dioxide and/or nitrogen. The amount of gas dissolved in the cider may be within the usual known range for ciders.

20 The dissolved carbon dioxide content may be substantially 1.8% by volume, and/or the dissolved nitrogen content may be substantially 18 parts per million (p.p.m).

25 A pump 206 is provided to pump cider from the cask 204 through a non-return valve 207 and along a pipe 208 in a chilled python known per se (not shown); the pipe comprising a heat exchange coil 210 in a remote cooling system known per se. The pipe 208 leads to a chilling coil 212 in a bath 214 of a chiller 216, from which coil a pipe 208A leads to a manual valve 218 (known per se) of a dispense outlet or nozzle 220 which may be provided at or on a drinks' bar. Bath 214 contains an ethylene
30 glycol and water cooling mixture 222, for example 50% glycol and 50%

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water. The cooling mixture 222 is cooled by an evaporator 224 of a refrigeration unit 226 comprising a condenser 228, a refrigerant pump 230, and an expansion arrangement 232. A pump 234 circulates the cold mixture 222 through piping 236 forming another python 238 with the pipe

5 208A.

In known manner, a blanket or atmosphere of non-oxidising gas (for example carbon dioxide and/or nitrogen) from a suitable supply 240 (via a pressure regulator 242) provides a top pressure in the cask 204 and

10 assists the pump 206 in the extraction of cider.

The top gas pressure in the cask 204 may be substantially 206.84kN/m^2 (30lbs/in²).

15 The pump 206 may develop a pressure in pipes 208, 208A of substantially 517.12kN/m^2 to substantially 551.58kN/m^2 valve (75 to 80 lbs/in²). Normally pump 206 is not operating, thus when the valve 218 is opened the pump pressure stored in the pipes 208, 208A drops to below a pre-determined desired value which is observed by pressure switch 244 of

20 a pump control (not shown) causing the pump 206 to operate to provide a pump output pressure of substantially 75 to 80 lbs/in². The chiller 216 is arranged to cool the cider passing through to the outlet nozzle 220 to a pre-determined temperature in the range of substantially -1°C to substantially -12°C , for example -6°C . The cider reaches the nozzle 220

25 at that pre-determined temperature and issues therefrom into an open-topped vessel 246 (Figure 21) which may be a drinking vessel, for example a drinking glass. In Figure 20 the cider issuing from the outlet opening of the outlet nozzle 220 passes through a sparkler 247 (known per

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se). Instead of or in addition to said sparkler 247, a known orifice plate may be mounted in nozzle 220. But if desired, neither an orifice plate nor a sparkler may be fitted.

- 5 When valve 218 is closed, the pressure switch 244 observes a build-up in pressure in the pipes 208, 208A above a predetermined value and the control switches off the pump 206.

 With reference to Fig 21, the draught cider 248 is delivered from the outlet 220 (Figure 20) into the drinking vessel 246, for example a
10 glass which is preferably rather tall and preferably has a clear or transparent wall. Preferably the vessel 246 is chilled before it receives the cider. The vessel 246 may be chilled to a temperature of substantially 4°C or less. For example a known bottle chiller may be used to chill the vessel to substantially 4°C whilst a known glass froster may chill the
15 vessel to substantially 0°C. A head of foam is shown at 250 when the vessel contains a full measured volume, for example a pint, of the cider.

 Immediately the cold cider 248 is poured into the chilled vessel 246, the vessel is placed in a shallow depth of water 252 in a dish part 254 of an
20 ultra-sound generating apparatus 256 in which the dish 254 is securely mounted or affixed against a base part 258 containing an ultra-sound emitter 260. The emitter 260 may be arranged to emit ultra-sound signals in a frequency range of substantially 20kHz to 70kHz. For example the cider may be subject to ultra-sound signals of a frequency of substantially
25 30 kHz or some other frequency selected from the aforesaid range, the water layer 252 providing an ultra-sonic transmission path or coupling. The cider 248 may be subject to the ultra-sound for any desired period,

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though usually a short period of a few seconds, for example substantially one to five seconds and more specifically about five seconds. --

The result in a short time is shown in Figure 22 in which the exposure to ultra-sonic signals has promoted sudden formation of bubbles of dissolved gas throughout the liquid cider 248 some bubbles 252A may be relatively large whilst others 252B may be relatively small and may tend to collect linearly in wavy lines which may snake upwardly. Also the head 250 may rise to increase its height or depth. The gas bubbles form nucleation sites encouraging the quick formation of ice in the cider 248 from water of the water content of the cider. The ice rises. It may be of a slushy character and tends to agglomerate in the lower part of and below the head 250 to form a slushy mass of ice 262 such as indicated in Figure 23 in the cider.

Going from the stage shown in Figure 21 to that in Figure 23 may only take one or two minutes so that the gas bubbling and the formation and visible development of the ice takes place fairly quickly and be interesting phenomena to observe through the glass 246.

Besides the ice forming in the cider 248 being an intriguing sight, it helps show the customer the cider is cold and that it has not been diluted by addition of ice from water other than that already in the cider.

One of the most interesting features is that the head 250 on the glass of cider may last for a considerable time, i.e. several times the duration of a head on cider arising from known methods. The head 250 may last for twenty minutes or so. Its longevity may be due to (i) the mass of ice 262 acting as a seal or barrier to gas attempting to leave the

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liquid cider body, and/or (ii) the fact that the ice 262 is keeping the head 250 cold.

5 An alternative method of applying the ultra-sound signals is represented in Figure 24, in which after the apparatus 202 in Figure 20 has dispensed a vessel or glass 246 of cider 248 an ultra-sound probe 264 powered through cable 266 is dipped into the cider for emitter 260A to give out ultra-sound signals. The probe 264 may be inserted into the cider before the full measured amount is supplied to the vessel 246.

10

In Figure 25, the dispense outlet 220 has been arranged to act as an ultra-sonic probe for example by providing it with an ultra-sonic emitter 260B. The ultra-sonic probe 220 in Figure 25 may emit ultra-sound signals whilst cider is passing through it to the vessel 246, and/or may
15 become partially immersed in the cider as shown and emit ultra-sound signals into the cider 248 in the vessel 246 whilst the measured volume of cider is still being supplied or after it has been supplied.

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CLAIMS

1. A beverage in an open topped vessel, said beverage
5 comprising a water content and a dissolved gas content, and in said vessel the beverage has a head of foam over ice, said ice being formed in the beverage from water of said water content.

2. A method of keeping an alcoholic beverage in an open-
10 topped vessel cool said beverage comprising a water content and a dissolved gas content, and said method comprising forming ice in the beverage in the open-topped vessel having a cooling effect on the beverage, said ice being formed in the beverage from water of said water content.

15 3. A method of sustaining cooling ice in a beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and wherein said ice is formed in the beverage from water of said water content, said method comprising providing a head of foam on
20 the beverage such that in the vessel said ice is covered by the head which acts as heat insulation above the ice against heat directed towards the ice from above the head.

4. A method of sustaining a head on a beverage in an open-
25 topped vessel, said beverage comprising a water content and a dissolved gas content said method comprising providing said head on the beverage and forming ice in the beerage from water of said water content, and in said vessel said ice having a cooling effect on the head from below an upper part of the head.

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5. An open-topped vessel of a beverage, the beverage comprising a water content and a dissolved gas content and being able to form a head as the beverage is dispensed into the vessel, the vessel of beverage having a head overlying an ice formation made of many ice crystals, the ice formation having been produced by ice forming in the beverage as it was dispensed or after it was dispensed into the vessel.

6. A beverage as claimed in claim 1 or claim 5 or a method as claimed in any one of claims 2 to 4 in which the beverage has been subjected to the effect of ultrasound signals and the beverage is draught beverage delivered into a vessel.

7. A beverage as claimed in claim 5 or claim 6 or a method as claimed in Claim 6, in which immediately before the draught beverage is delivered into the vessel said beverage is cooled to a temperature below the freezing point of water at ambient atmospheric pressure.

8. A method of serving draught beverage in an open-topped vessel, said beverage comprising a water content and a dissolved gas content, and said method comprising cooling the beverage to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled beverage into said vessel, said cooled beverage being subjected to the effect of ultrasound signals or to the effect of other ice and/or gas bubble nucleation means.

9. A beverage as claimed in any one of claims 5 to 7, or a method as claimed in claim 8, in which the ultrasound signals are applied externally of said vessel.

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10. A beverage as claimed in any one of claims 5 to 9, or a method as claimed in claim 8 or 9, in which the ultrasound signals are applied internally of said vessel to the cooled beverage.

5 11. A beverage as claimed in claim 10 or a method as claimed in claim 10, in which an ultrasound signal emitter is disposed in the beverage in the vessel emitting ultrasound signals into the beverage in the vessel.

10 12. A beverage as claimed in any one of claims 9, 10, or 11 or a method as claimed in any one of claims 9, 10, or 11, in which a dispense outlet or nozzle from which beverage is delivered into said vessel is adapted to act as an ultra-sonic emitter to provide aforesaid ultrasound signals.

15 13. A beverage as claimed in claim 12 or a method as claimed in claim 12, in which aforesaid ultrasound signals are applied to aforesaid beverage flowing through the dispense outlet.

20 14. A beverage as claimed in any one of claims 5 to 13, or a method as claimed in any one of claims 6 to 13 in which the ultrasound signals have a frequency in the range of 20kHz to 70kHz.

25 15. A beverage or a method as claimed in claim 14, in which the ultrasound signals have a frequency of substantially 30kHz.

16. A beverage as claimed in any one of claims 1, 5, 6, 7, 9, to 15, or a method as claimed in any one of claims 2 to 4 or 8 to 14, in which a mass of said ice develops downwards in the beverage below the head.

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17. A beverage as claimed in any one of claims 1, 5, 6, 7 or 9 to 16, or a method as claimed in any one of claims 2 to 4 or 8 to 16 in which the vessel is chilled before beverage is delivered thereinto.
- 5 18. A beverage or a method as claimed in claim 17, in which the vessel is chilled to a temperature of substantially 4°C, or the vessel is chilled to a temperature less than 4°C.
19. A beverage or a method as claimed in claim 17, in which the vessel
10 is chilled to a temperature of substantially 0°C.
20. A beverage as claimed in claim 7 or in any one of claims 9 to 19 when appended to claim 7, or a method as claimed in claim 8 or in any one of claims 9 to 19 when appended to claim 8, in which the beverage is
15 cooled to a temperature between substantially -1°C and substantially -12°C.
21. A beverage or a method as claimed in claim 20, in which the beverage is cooled to a temperature between substantially -4°C and
20 substantially -6°C.
22. A beverage as claimed in any one of claims 1, 5, 6, 7, or 9 to 21 or a method as claimed in any one of claims 2 to 4 or 8 to 21, in which the vessel has a wall portion of sufficient transparency to allow the
25 contents of the vessel to be visible through said wall portion.
23. A beverage or a method as claimed in claim 22, in which the vessel is a glass drinking vessel.

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24. A beverage as claimed in any one of claims 1, 5, 6, 7 or 9 to 23, or a method as claimed in any one of Claims 2 to 4 or 8 to 23 in which the beverage has a pale beer colour.

5 25. A beverage as claimed in any one of claims 1, 5, 6, 7 or 9 to 24 or a method as claimed in any one of claims 2 to 4 or 8 to 24 in which aforesaid dissolved gas comprises carbon dioxide and/or comprises nitrogen.

10 26. A beverage or a method as claimed in claim 25, in which the dissolved nitrogen content in the beverage is in the range of substantially zero parts per million (p.p.m.) to substantially 100 parts p.p.m.

15 27. A beverage or a method as claimed in claim 25 or in claim 26, in which the dissolved carbon dioxide content is about zero % by volume or greater.

20 28. A beverage or a method as claimed in claim 27, in which the carbon dioxide is substantially 2.2% or substantially 4% or substantially 5% by volume.

25 29. A beverage as claimed in any one of claims 5 to 7 or in any one of claims 9 to 28 when appended to claim 6, or a method as claimed in claim 8, or in any one of claims 9 to 28 when appended to claim 8, in which the ultrasound signals are accompanied by a mechanically or electrically produced audible performance and/or a visible light display.

30 30. A beverage or a method as claimed in claim 29, in which the audible performance is a tuneful or musical sound.

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31. A beverage or a method as claimed in claim 29 or claim 30, in which the visible light display comprises visible flashes of light.

5 32. A beverage as claimed in claim 6 or claim 7, or in any one of claims 9 to 32 when appended to claim 6, or a method as claimed in claim 8, or in any one of claims 9 to 31 when appended to claim 8, in which the beverage is subjected to ultrasound within an enclosure arranged to conceal the vessel from view from at least one side of said enclosure.

10

33 An alcoholic beverage comprising a water content and a dissolved gas content wherein prior to being drunk said beverage is cooled to a temperature below the freezing point of water at ambient atmospheric pressure and delivered in a container to be drunk exposed to ambient atmospheric pressure, and wherein in said container aforesaid gas bubbles out of the beverage and at least a portion of said water content becomes ice.

15

34. An alcoholic beverage to be available on draught and comprising a water content and a dissolved gas content, wherein prior to being drunk the draught beverage is to issue, at a temperature below the freezing point of water at ambient atmospheric pressure, from an outlet into a container open to ambient atmospheric pressure so that the aforesaid gas bubbles out of the beverage and at least a portion of said water content becomes ice.

20

25

35. A beverage as claimed in Claim 33 and in any one of Claims 5 to 7 or 9 to 32, or as claimed in Claim 34 and in any one of Claims 5 to 7 or 9 to 32, wherein said container is said open-topped vessel.

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36. A beverage as claimed in claim 35 in which said vessel has at least a wall portion of sufficient transparency to allow the contents of the vessel to be visible through said wall portion.

5 37. A beverage as claimed in claim 35 or claim 36 in which the vessel is made of glass.

38. A beverage as claimed in any one of claims 35 to 37, in which the vessel has a shape or formation to promote formation of said ice.

10

39. A beverage as claimed in any one of claims 35 to 38, in which the vessel has an internal surface arranged to provide nucleation sites to promote formation of said ice.

15 40. A beverage as claimed in claim 39, in which said surface has at least a surface portion which is roughened.

41. A beverage as claimed in any one of claims 35 to 40, in which the vessel has at least a wall portion arranged to change colour automatically
20 with variations in temperature.

42. A beverage as claimed in claim 41, in which said wall portion comprises thermo-chromic material.

25 43. A beverage as claimed in any one claims 33 to 42 in which the formed ice includes therein one or more streaks or regions of one or more colours which contrasts(s) with the colour of the ice and/or beverage.

44. A method of serving a draught alcoholic beverage which comprises
30 a water content and a dissolved gas content, said method comprising

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issuing the draught beverage from an outlet into an open topped vessel, prior to said issuing, storing or handling the beverage in a manner which impedes loss of aforesaid dissolved gas from the beverage and cooling said beverage to a temperature below the freezing point of water at said ambient atmospheric pressure, and in said vessel aforesaid gas bubbles out of the beverage at least a portion of said water becomes ice.

45. A method of providing a visual display or effect within an open-topped vessel having at least a portion of wall of some transparency, said method comprising providing a draught alcoholic beverage comprising a water content and a dissolved gas content, issuing the draught beverage from an outlet into a said vessel, prior to said issuing, storing or handling of the beverage which impedes loss of aforesaid dissolved gas from the beverage and cooling said beverage to a temperature below the freezing point of water at said ambient atmospheric pressure, a visual display or effect developing in the beverage in the vessel, said visual display or effect comprising aforesaid gas bubbling out of the beverage and formation of ice due to at least a portion of said water becoming ice.

46. A method as claimed in claim 44, in which the vessel has a wall portion of some transparency.

47. A method as claimed in any one of claims 44 to 46, in which the vessel comprises glass.

48. A method as claimed in any one of claims 44 to 47, in which formation of ice develops in the vessel so as to increase the amount and extent of the ice from substantially an upper level of the beverage downwards through the beverage.

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49. A method as claimed in any one of claims 44 to 48, in which the vessel has at least a wall portion which changes colour automatically with variation in temperature.

5 50. A method as claimed in claim 49, in which said wall portion comprises thermo-chromic material.

51. A method as claimed in any one of claims 44 to 49 in which the vessel has a shape or formation to encourage the forming of the ice.

10

52. A method as claimed in any one of claims 44 to 51, in which the vessel has one or more internal formations to encourage the forming of the ice.

15 53. A method as claimed in claim 52, in which at least a portion of an internal wall of the vessel has a roughened texture.

54. A method as claimed in any one of claims 44 to 53, in which the vessel is adapted to encourage formation of further ice in the beverage
20 below an upper layer of forming ice, and said further ice rising to joint said upper layer.

55. A method as claimed in any one of claims 44 to 54, in which an implement is inserted into the beverage in the vessel to encourage
25 formation of said ice.

56. A method as claimed in claim 55, in which said implement is a thermometer.

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57. A method as claimed in claim 56, in which said implement is a swizzle-stick.

58. A method as claimed in any one of claims 44 to 57, in which
5 colouring material or dye is provided to form at least one coloured streak or region in the beverage and/or ice, the colour of said material or dye being in contrast to that of the ice and/or beverage so as to be visible.

59. A method as claimed in claim 58, when appended to any one of
10 claims 47 to 57, in which said implement is used to add the colouring material or dye to the beverage and/or ice.

60. A beverage as claimed in any one of Claims 1, 5 to 7, or 9 to 43,
or a method as claimed in any one of Claims 2 to 4, 8, 9 to 32 or 44 to
15 59, in which said ice comprises slush.

61. Apparatus to supply a draught beverage, comprising beverage
cooling heat exchange means, a beverage outlet for cold beverage from
said heat exchange means to issue from the outlet, openable and closable
20 valve means to control supply of beverage to said outlet, and a beverage circulation loop for beverage to circulate in said loop.

62. Apparatus as claimed in claim 61, in which the beverage circulates
in said loop when the valve means is closed.

25 63. Apparatus as claimed in claim 61 or claim 62, in which said loop comprises pump means to circulate beverage in the loop.

64. Apparatus as claimed in any one of claims 61 to 63, in which the
30 beverage is circulated to reduce the risk of, or avoid, freezing beverage blocking a beverage supply path to the outlet.

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65. Apparatus as claimed in any one of claims 61 to 64, in which said loop includes a beverage flow passage in said heat exchange means.

5 66. Apparatus as claimed in any one of claims 61 to 65, comprising a unit or dispenser mountable on a counter of a drinks' bar and comprising the heat exchange means and the outlet.

10 67. Apparatus as claimed in any one of claims 61 to 66 in which a beverage flow path connects a reservoir of said draught beverage to said heat exchange means.

68. Apparatus as claimed in claim 67, in which said flow path comprises at least a portion of said loop.

15 69. Apparatus as claimed in claim 67, in which said flow path divides into a plurality of beverage routes, and said loop comprises one or more of said routes.

20 70. Apparatus as claimed in claim 67, in which intermediate said reservoir and said first-mentioned beverage cooling heat exchange means, the beverage is subject to the effect of second beverage cooling heat exchange means.

25 71. Apparatus as claimed in claim 67 in which the reservoir is subjected to cooling.

72. Apparatus as claimed in any one of claims 61 to 67, in which said heat exchange means is first heat exchange means and second beverage

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cooling heat exchange means is provided to act on at least a portion of said loop.

73. Apparatus as claimed in claim 72, in which coolant common to the first and second heat exchange means circulates therethrough.

74. Apparatus as claimed in claim 67, in which intermediate said reservoir and said loop the beverage is subject to the effect of further beverage cooling heat exchange means.

10

75. Apparatus as claimed in any one of claims 61 to 74 in which the apparatus is arranged to operate so that the beverage which emerges from said outlet is at a temperature below the freezing point of water at the ambient atmospheric pressure.

15

76. Apparatus as claimed in any one of claims 61 to 74, in which the apparatus is arranged to operate so that the beverage which emerges from said outlet is at a temperature of between substantially -1°C and substantially -12°C .

20

77. A beverage as claimed in Claim 1 or Claim 5 or as claimed in any one of Claims 6, 7, 9 to 32 or 60 when any one is appended to Claim 1 or Claim 5, or a method as claimed in Claim 3 or Claim 4 or as claimed in any one of Claims 6 to 8 or 9 to 32 when any one is appended to Claim 3 or Claim 4, or an apparatus to supply a beverage as claimed in any one of Claims 61 to 76, in which the beverage is non-alcoholic.

25

78. A beverage as claimed in Claim 1 or Claim 5 or as claimed in any one of Claims 6, 7, 9 to 32 or 60 when any one is appended to Claim 1 or Claim 5, or a method as claimed in any one of Claims 6 to 8 or 9 to 32

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when any one is appended to Claim 3 or Claim 4, or an apparatus to supply a beverage as claimed in any one of Claims 61 to 76, in which the beverage is alcoholic.

5 79. A beverage, a method or an apparatus as claimed in Claim 78 in which said alcoholic beverage is a beer.

80. A beverage, a method or an apparatus as claimed in Claim 76 or Claim 77, in which said beer is a lager.

10

81. A beverage, a method or an apparatus as claimed in Claim 78, in which said alcoholic beverage is a cider.

82. A method of serving draught cider in an open-topped vessel and
15 wherein said cider comprises a water content and a dissolved gas content, said method comprising cooling the cider to a temperature below the freezing point of water at ambient atmospheric pressure, and delivering the cooled cider into said vessel, said cooled cider being subjected to the effect of ultra-sound signals.

20

83. A method as claimed in Claim 82, in which the cider is cooled to a temperature in the range of substantially -1°C to substantially -12°C .

84. A method as claimed in Claim 83, in which the cider is cooled to a
25 temperature of substantially -6°C .

85. A method as claimed in any one of Claims 82 to 84, in which the cooled cider issues from a dispense outlet through a sparkler.

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86. A method as claimed in any one of Claims 82 to 84, in which the cooled cider passes through an orifice plate in a dispense outlet from which the cider issues.

5 87. A method as claimed in any one of Claims 82 to 86, in which the open-topped vessel is chilled before receiving the cider.

88. A method as claimed in Claim 87, in which the open-topped vessel is chilled to substantially 4°C or chilled to a temperature lower than 4°C.

10

89. A method as claimed in Claim 88, in which the open-topped vessel is chilled to substantially 0°C.

15

90. A method as claimed in any one of Claims 82 to 89, in which said ultra-sound signals have a frequency in the range of substantially 20kHz to substantially 70 kHz.

20

91. A method as claimed in Claim 90, in which the ultra-sound signals have a frequency of substantially 30kHz.

25

92. A method as claimed in any one of Claims 82 to 91, in which the ultra-sound signals are applied externally of said vessel to said vessel.

93. A method as claimed in any one of Claims 82 to 91, in which the ultra-sound signals are applied internally of said vessel to the cooled cider.

30

94. A method as claimed in Claim 93 in which an ultra-sonic signals emitter is disposed in the cider in the vessel for emitting ultra-sound signals into the cider in the vessel.

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95. A method as claimed in Claim 93 or 94, in which a or the dispense outlet from which the cooled cider issues into said vessel is adapted to act as an ultra-sonic signal emitter to produce aforesaid ultra-sound signals.

5

96. A method as claimed in Claim 95, in which aforesaid ultra-sound signals are applied to aforesaid cider flowing through the dispense outlet.

97. A method as claimed in any one of Claims 82 to 96, in which the dissolved gas content comprises carbon dioxide and/or nitrogen.

10

98. A method as claimed in Claim 97, in which the carbon dioxide content is substantially zero % by volume or greater and/or the nitrogen content is substantially zero parts per million (p.p.m.) or greater.

99. Cider in an open-topped vessel wherein said cider comprises a dissolved gas content and a water content, and wherein said cider has a head of foam over ice, said ice being formed in the cider from water of said water content.

100. Cider as claimed in Claim 99, in which said head and ice are produced at least in part by performance of a method as claimed in any one of claims 82 to 98.

101. A method of sustaining a head on cider in an open-topped vessel wherein said cider comprises a dissolved gas content and a water content, said method comprising providing a head on the cider and forming ice in the cider from water of said water content, and in said vessel said ice forming a layer covered by said head.

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102. A method as claimed in Claim 101, in which said head and ice are produced at least in part by performance of a method as claimed in any one of Claims 82 to 98.

5 103. A beverage as claimed in any one of Claims 78 to 81, in which the beverage comprises 2.5% to 7% alcohol by volume (abv).

104. A beverage as claimed in Claim 103, in which the beverage comprises 3.5% to 5.5% abv.

10

105. A beverage as claimed in any one of Claims 77 to 81 or 103 or 104, in which the beverage is a draught beverage.

15

106. A beverage as claimed in Claim 1 and substantially as hereinbefore described with reference to Figures 1 to 19 or Figures 20 to 25 of the accompanying drawings.

20

107. A method of keeping a beverage in an open-topped vessel cool, substantially as hereinbefore described with reference to Figures 2 to 4, or Figures 2 to 5, or Figures 2 to 4 and 6, or Figures 2 to 4 and 7, or Figures 1 to 4, or Figures 1 to 5, or Figures 1, 2 to 4 and 6, or Figures 1, 2 to 4 and 7, or Figures 8 to 15, or Figures 8 to 16, or Figures 8 to 15 and 17, or Figures 1, and 8 to 15, or Figures 1 and 8 to 16, or Figures 1 and 8 to 15 and 17, or Figures 18 and 19, or Figures 21 to 23, or Figures 22 to 24 or Figures 22, 23 and 24, or Figures 20 to 23, or Figures 20 and 22 to 24, or Figures 20 and 22, 23 and 25 of the accompanying drawings.

25

108. A method of sustaining cooling ice in a beverage in an open-topped vessel and wherein said ice is formed in the beverage from water of a water content of the beverage, said method being substantially as

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hereinbefore described with reference to Figures 2 to 4, or Figures 2 to 5, or Figures 2 to 4 and 6, or Figures 2 to 4 and 7, or Figures 1 to 4, or Figures 1 to 5, or Figures 1, 2 to 4 and 6, or Figures 1, 2 to 4 and 7, or Figures 8 to 15, or Figures 8 to 16, or Figures 8 to 15 and 17, or Figures 1, and 8 to 15, or Figures 1 and 8 to 16, or Figures 1 and 8 to 15 and 17, or Figures 18 and 19, or Figures 21 to 23, or Figures 22 to 24, or Figures 22, 23 and 24, or Figures 20 to 23, or Figures 20 and 22 to 24, or Figures 20 and 22, 23 and 25 accompanying drawings.

10 109. A method of sustaining a head on a beverage in an open-topped vessel, substantially as hereinbefore described with reference to Figures 2 to 4, or Figures 2 to 5, or Figures 2 to 4 and 6, or Figures 2 to 4 and 7, or Figures 1 to 4, or Figures 1 to 5, or Figures 1, 2 to 4 and 6, or Figures 1, 2 to 4 and 7, or Figures 8 to 15, or Figures 8 to 16, or Figures 8 to 15 and 17, or Figures 1, and 8 to 15, or Figures 1 and 8 to 16, or Figures 1 and 8 to 15 and 17, or Figures 18 and 19, or Figures 21 to 23, or Figures 22 to 24, or Figures 22, 23 and 24, or Figures 20 to 23, or Figures 20 and 22 to 24, or Figures 20 and 22, 23 and 25 accompanying drawings.

20

110. A method of serving draught beverage in an open-topped vessel, substantially as hereinbefore described with reference to Figures 2 to 4, or Figures 2 to 5, or Figures 2 to 4 and 6, or Figures 2 to 4 and 7, or Figures 1 to 4, or Figures 1 to 5, or Figures 1, 2 to 4 and 6, or Figures 1, 2 to 4 and 7, or Figures 8 to 15, or Figures 8 to 16, or Figures 8 to 15 and 17, or Figures 1, and 8 to 15, or Figures 1 and 8 to 16, or Figures 1 and 8 to 15 and 17, or Figures 18 and 19, or Figures 21 to 23, or Figures 22 to 24, or Figures 22, 23 and 24, or Figures 20 to 23, or Figures 20 and 22 to 24, or Figures 20 and 22, 23 and 25.

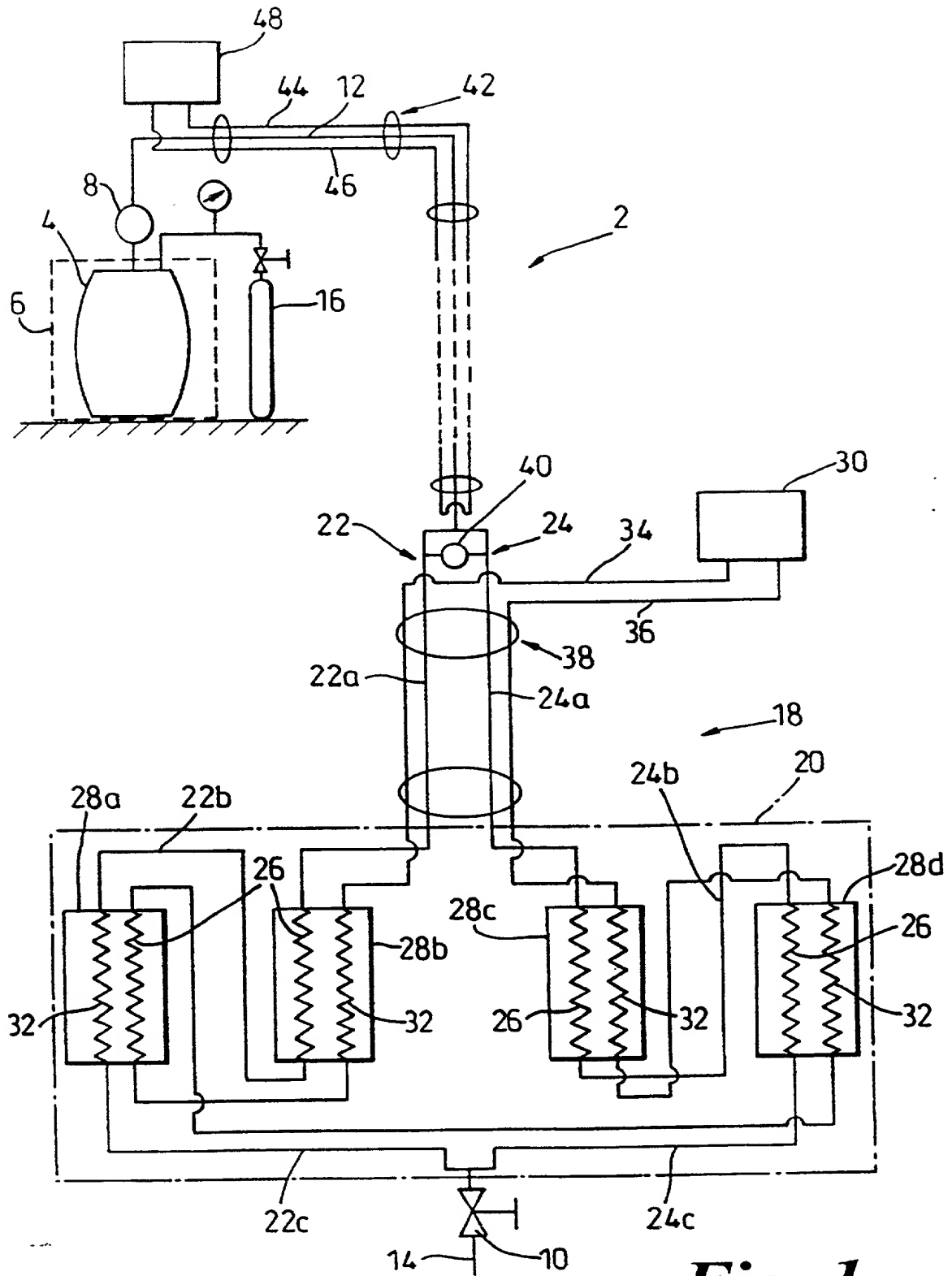
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ABSTRACT

A BEVERAGE

- 5 A draught beverage 170 which may be alcoholic or non-alcoholic, for example a lager or cider in an open-topped drinking vessel or glass 172. The beverage comprises a water content and dissolved gas content. The draught beverage is dispensed from a font at a cooled temperature below the freezing point of water at ambient atmospheric pressure. The dispense
- 10 temperature may be in the range of -1°C to -12°C . The beverage in the glass may or may not be subjected to external excitement energy, for example ultra-sound, to encourage formation of nucleation sites in the beverage. Either way dissolved gas bubbles out of the beverage causing occurrence of nucleation sites at which ice 188A, 188B from the water
- 15 content forms. At least in part the ice has a slushy character. A head 174 also forms on the dispensed draught beverage and below the head the ice 188A, 188B locates and develops downwards into the beverage.
- 20 To be accompanied, when published, by Figure 19 of the drawings.

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**Fig. 1**

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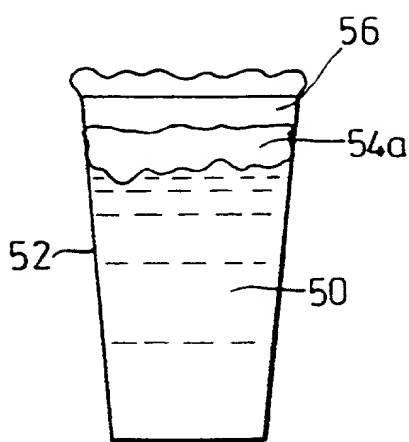


Fig. 2

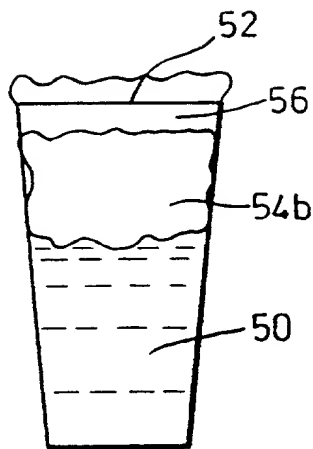


Fig. 3

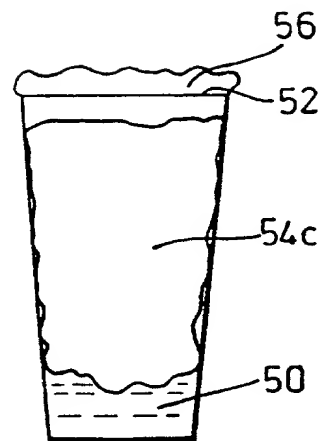


Fig. 4

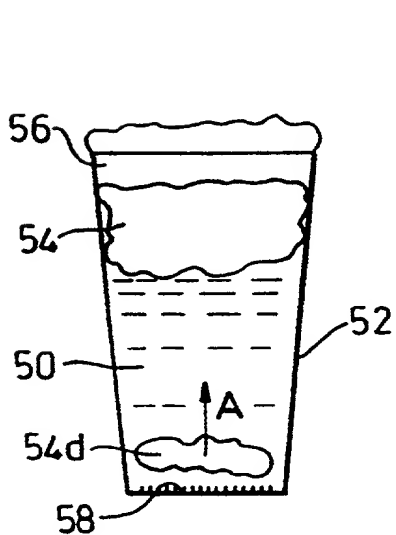


Fig. 5

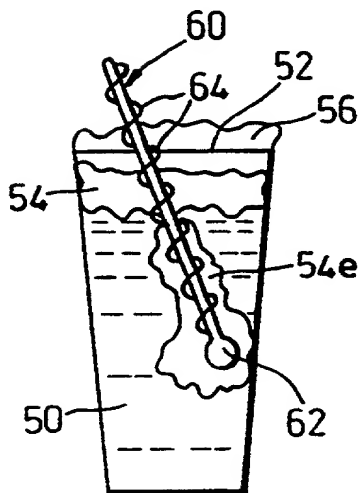


Fig. 6

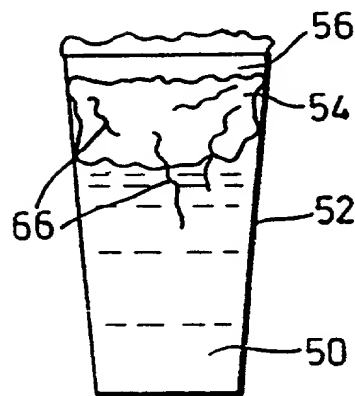


Fig. 7

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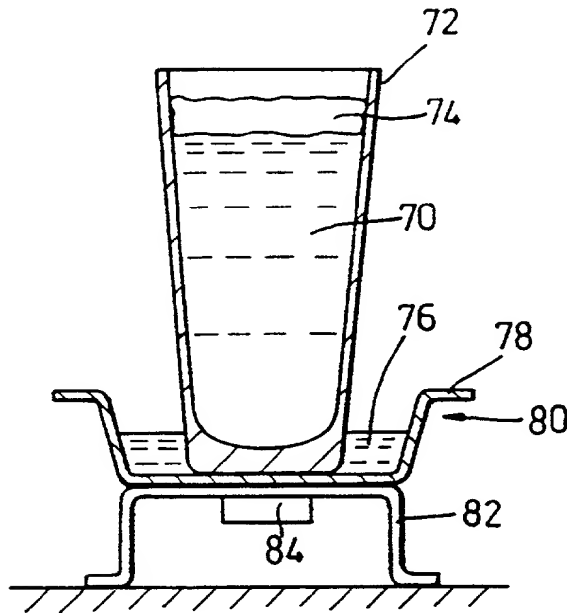


Fig. 8

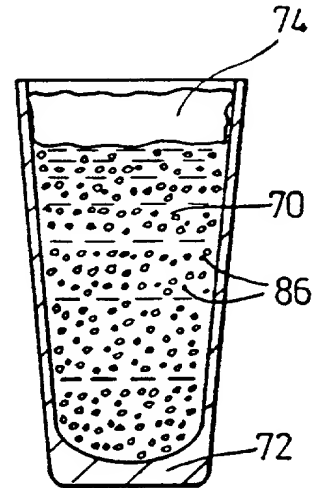


Fig. 9

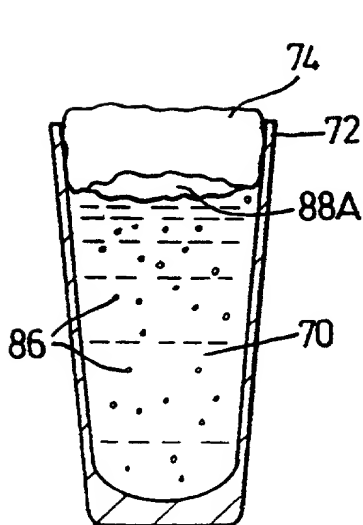


Fig. 10

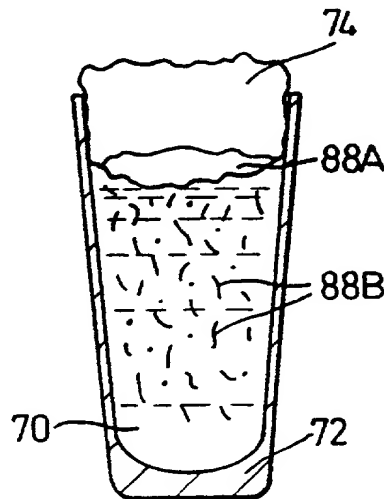


Fig. 11

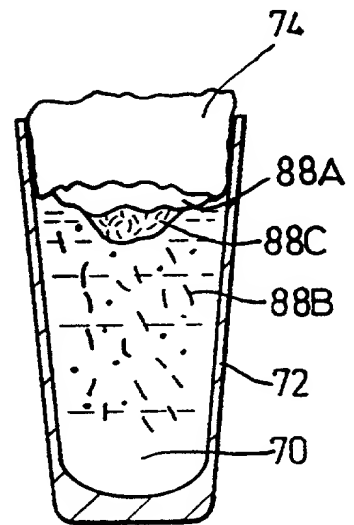


Fig. 12

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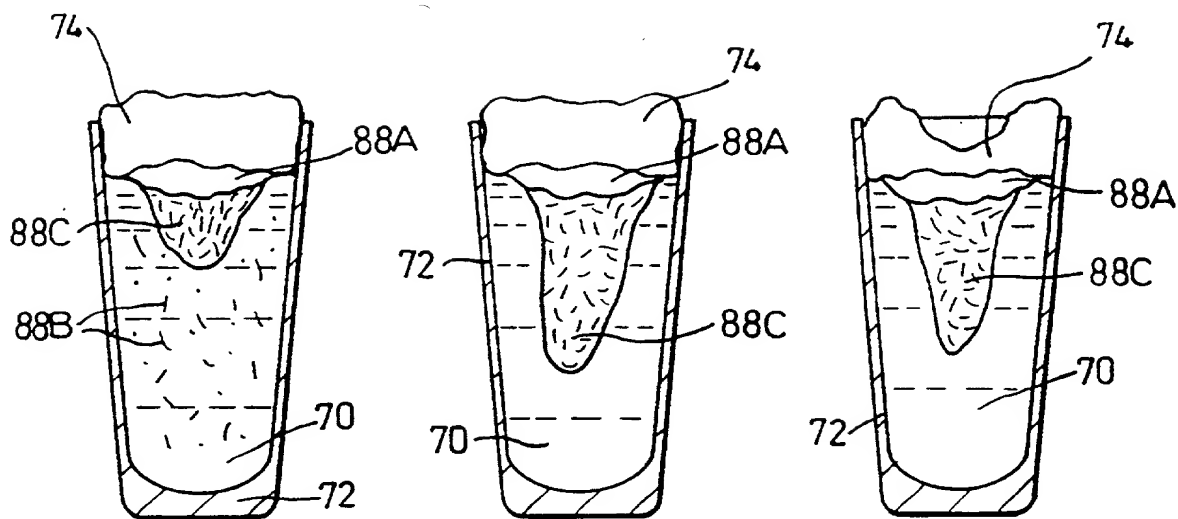


Fig. 13 Fig. 14 Fig. 15

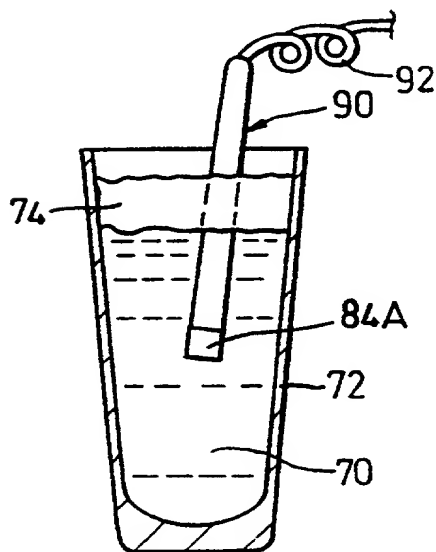


Fig. 16

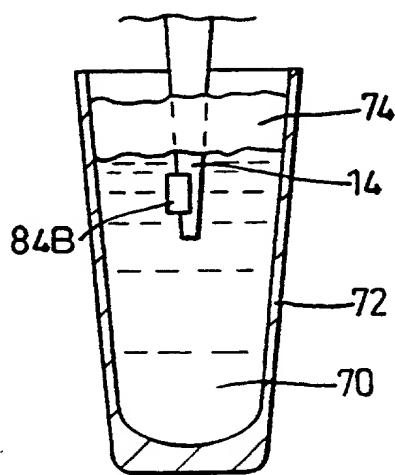
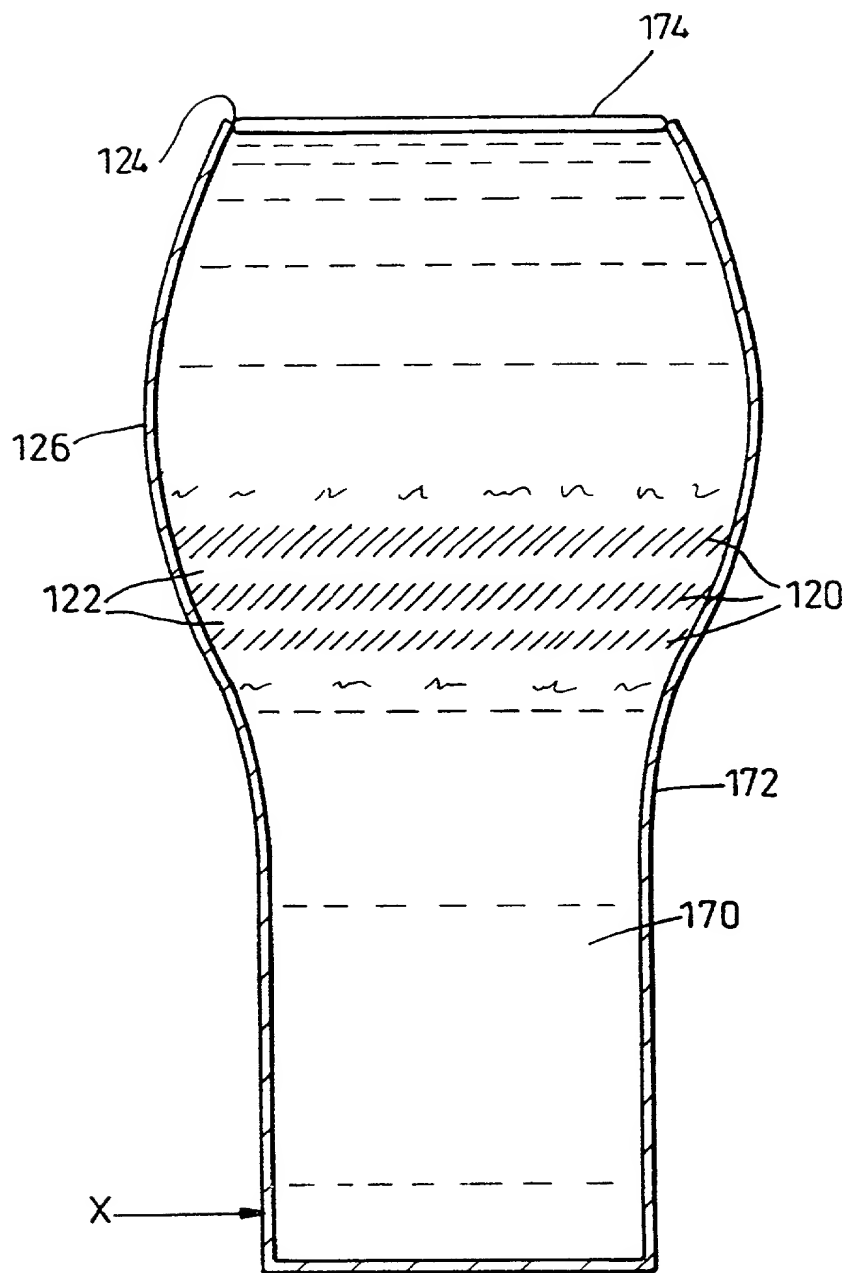


Fig. 17

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**Fig. 18**

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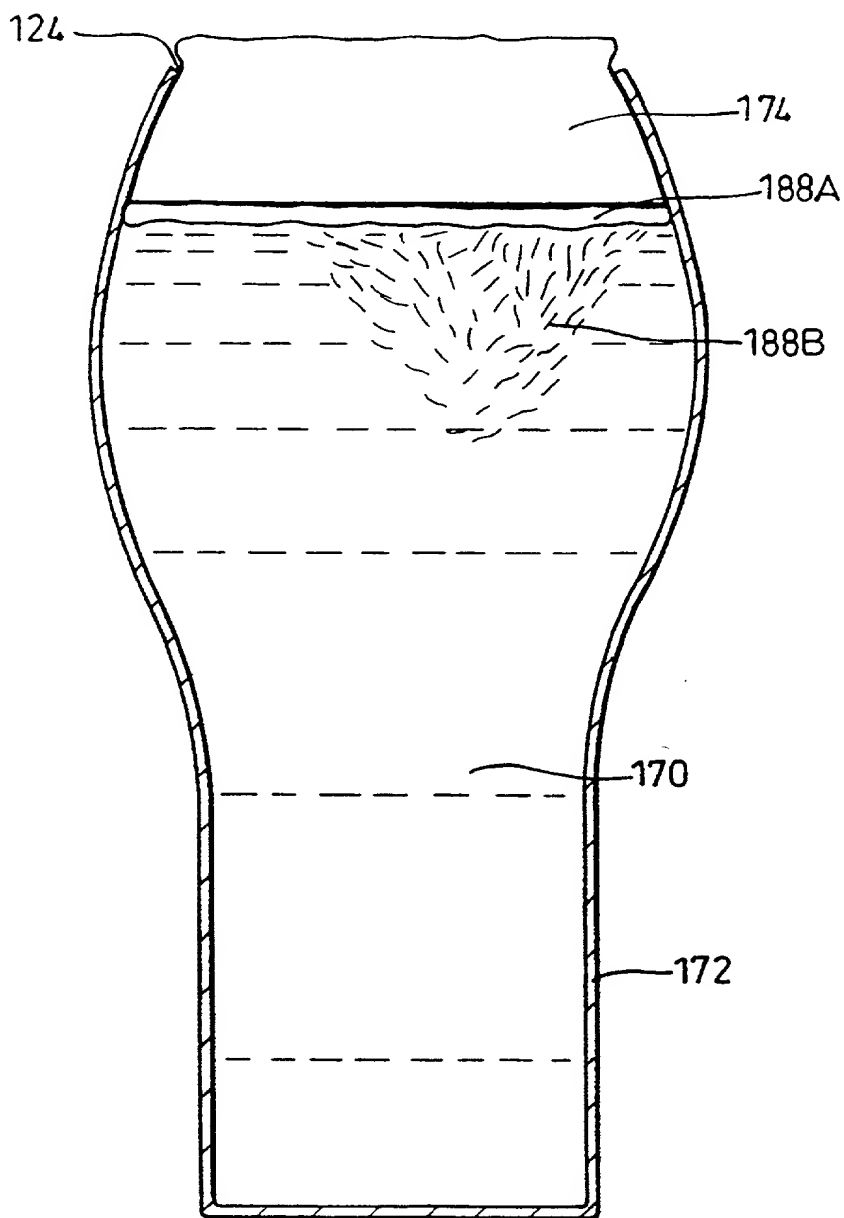


Fig. 19

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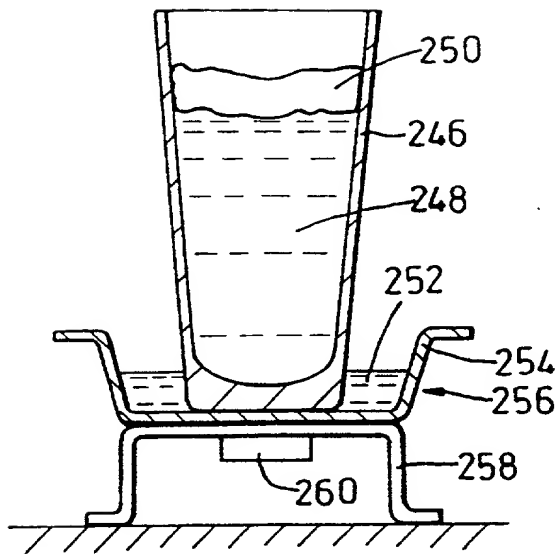


Fig. 21

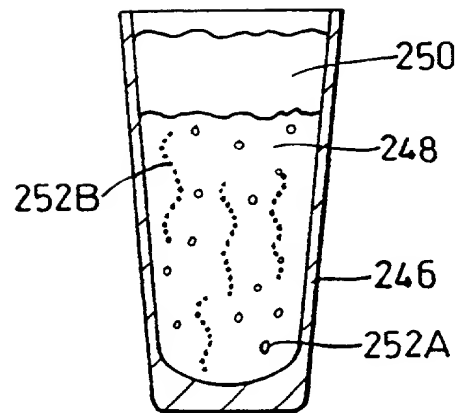


Fig. 22

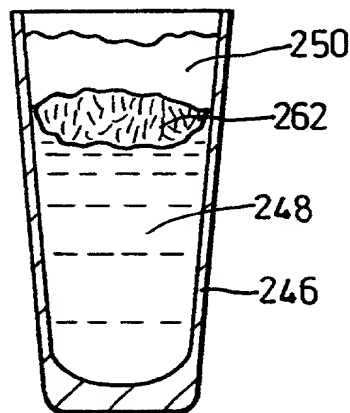


Fig. 23

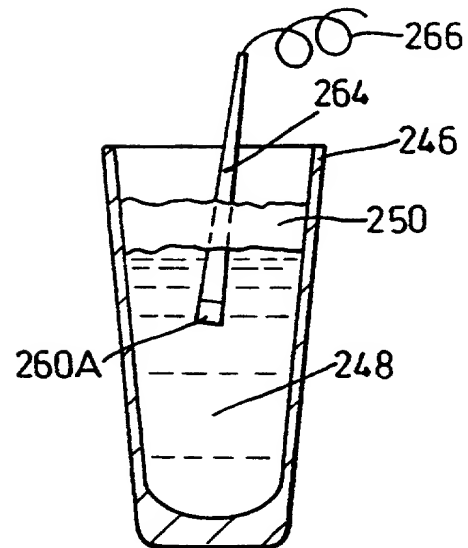


Fig. 24

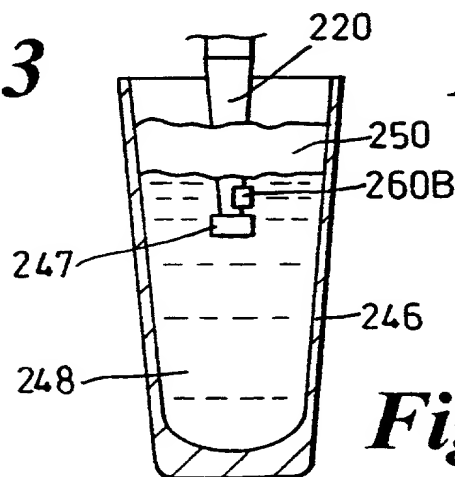


Fig. 25

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FILE NO: RBHA3300
P-11**COMBINED DECLARATION
AND POWER OF ATTORNEY****(Original, Design, National Stage of PCT, Divisional, Continuation or C-I-P Application)**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name; I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

A BEVERAGE

This declaration is of the following type:

- ☐ original
☐ design
☒ national stage of PCT
☐ divisional
☐ continuation
☐ continuation-in-part (C-I-P)

the specification of which: *(complete (a), (b), or (c))*

- (a) ☐ is attached hereto
- (b) ☐ was filed on _____ as Application Serial No. _____ and was amended on _____ *(if applicable)*
- (c) ☒ was described and claimed in PCT International Application No. PCT/GB99/01551 filed on 14 MAY 1999 and was amended on _____ *(if applicable)*

Acknowledgement of Review of Papers and Duty of Candor

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of the subject matter claimed in this application in accordance with Title 37, Code of Federal Regulations § 1.56.

- ☐ In compliance with this duty there is attached an information disclosure statement. 37 CFR 1.98.

Priority Claim

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT International application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT International application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application on which priority is claimed

(complete (d) or (e))

- (d) ☐ no such applications have been filed
- (e) ☒ such applications have been filed as follows:

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FILE NO: RBH

PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO SAID APPLICATION				
COUNTRY	APPLICATION NO.	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
GREAT BRITAIN	9810309.6	15.05.98		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
GREAT BRITAIN	9828321.1	23.12.98		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
GREAT BRITAIN	9828317.9	23.12.98		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
GREAT BRITAIN	9901018.3	19.01.99		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO SAID APPLICATION				
COUNTRY	APPLICATION NO.	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
				<input type="checkbox"/> YES <input type="checkbox"/> NO
				<input type="checkbox"/> YES <input type="checkbox"/> NO
				<input type="checkbox"/> YES <input type="checkbox"/> NO

Claim for Benefit of Prior U.S. Provisional Application(s)

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States Provisional application(s) listed below:

Provisional Application Number	Filing Date

Claim for Benefit of Earlier U.S./PCT Application(s) under 35 U.S.C. 120

(complete this part only if this is a divisional, continuation or C-I-P application)

I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s) or PCT international application(s) designating the United States of America this is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior application(s) in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose information as defined in Title 37, Code of Federal Regulations, § 1.56 which occurred between the filing date of the prior application(s) and the national or PCT International filing date of this application:

(Application Serial No.)	(Filing Date)	(Status) (Patented, Pending, Abandoned)
(Application Serial No.)	(Filing Date)	(Status) (Patented, Pending, Abandoned)

Power of Attorney

As a named inventor, I hereby appoint Dana M. Raymond, Reg. No. 18,540; Frederick C. Carver, Reg. No. 17,021; Francis J. Hone, Reg. No. 18,662; Joseph D. Garon, Reg. No. 20,420; Arthur S. Tenser, Reg. No. 18,839; Ronald B. Hildreth, Reg. No. 19,498; Thomas R. Nesbitt, Jr., Reg. No. 22,075; Robert Neuner, Reg. No. 24,316; Richard G. Berkley, Reg. No. 25,465; Richard S. Clark, Reg. No. 26,154; Bradley B. Geist, Reg. No. 27,551; James J. Maune, Reg. No. 26,946; John D. Mumane, Reg. No. 29,836; Henry Tang, Reg. No. 29,705; Robert C. Scheinfeld, Reg. No. 31,300; John A. Fogarty, Jr., Reg. No. 22,348; Louis S. Sorely Reg. No. 32,439 and Rochelle K. Seide Reg. No. 32,300 of the firm of BAKER & BOTTS, L.L.P., with offices at 30 Rockefeller Plaza, New York, New York 10112, as attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

BAKER & BOTTS LLP
FILE NO: RBH

FULL NAME OF SOLE OR FIRST INVENTOR	LAST NAME SCULLION	FIRST NAME SIMON	MIDDLE NAME DANIEL
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DATE	SIGNATURE OF INVENTOR 4/1/2001 <i>[Signature]</i>		
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DATE	SIGNATURE OF INVENTOR 4th Jan, 2001 <i>[Signature]</i>		
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RESIDENCE & CITIZENSHIP	CITY ASHBOURNE	STATE or FOREIGN COUNTRY GREAT BRITAIN GBN	COUNTRY OF CITIZENSHIP GREAT BRITAIN
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DATE	SIGNATURE OF INVENTOR 5th Jan, 2001 <i>[Signature]</i>		
FULL NAME OF FOURTH JOINT INVENTOR, IF ANY	LAST NAME	FIRST NAME	MIDDLE NAME
RESIDENCE & CITIZENSHIP	CITY	STATE or FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE or COUNTRY
DATE	SIGNATURE OF INVENTOR		
FULL NAME OF FIFTH JOINT INVENTOR, IF ANY	LAST NAME	FIRST NAME	MIDDLE NAME
RESIDENCE & CITIZENSHIP	CITY	STATE or FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE or COUNTRY
DATE	SIGNATURE OF INVENTOR		